### Limited Energy Study (Glass)

### Energy Engineering Analysis Program (EEAP) Fort Knox, Kentucky

Final Report Volume 3 of 3

CONTRACT #DACA01-94-D-0034 SYSTEMS CORP PROJECT #94013.02 OCTOBER 28, 1994



19971016 192

**SYSTEMS**corp

Approved to public schools

Decidence Gulkob

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### **VOLUME III**

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### FEMP PROJECT 4: INFRA-RED HEAT AT 22 BUILDINGS FY94 LIMITED ENERGY STUDY (GLASS), FT. KNOX, KY 5

This section includes an FEMP project packet for FEMP Project 4: Infra-red Heat at 22 Buildings. Following this table of contents is a project summary table, the life cycle cost analysis for the project, and the life cycle cost analysis, cost estimates, and calculations for each building/area included in the project. Below is a detailed index of the information included in this section.

Table 5.1:	Project	Sumr	nary	Inf	ra-	rec	d F	<del>l</del> ea	at :	at	22	2 I	3u	ilc	lir	ıgs	S						•					. 5-2
FEMP Pro	ject 4 LC	CCA				•					•		•	•			•	•		 •	•	•	•		•		•	. 5-3
Buildings:																												
5220																												. 5-8
5253																									• (			5-22
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NOTE: All the above buildings are also included in ECIP Project 2 except Hangars 5220 and 5253. This will increase the flexibility of the installation's funding alternatives.

### TABLE 5.1 PROJECT SUMMARY: INFRA-RED HEAT - FEMP PROJECT 4

ECO	BUILDING	BASELINE ENERGY (MBTU)	ECO ENERGY (MBTU)	ENERGY SAVINGS (MBTU)	1ST YEAR SAVINGS	INVESTMENT	NON-ENERGY ANNUAL RECURRING	NON-ENERGY NON- NON- RECURRING	SPB (YR)	SIR
		(5.1								
-	5220	5.686	2.789	2,897	\$25,042	\$78,231	90	\$7,984	3.12	5.05
- +	5253	3.528	1 730	1,797	\$15,647	\$45,837	\$0	260'2\$	2.93	5.38
- +	6113 6118 6142 6147	14 811	7 265	7.547	\$77.721	\$503,778	\$3,960	\$191,341	6.48	2.44
- 7	6560 8564 8578 8577	0 2 8	3 222	3 347	\$36,858	\$263,339	\$2,970	\$108,338	7.14	2.22
	6592	1,317	646	671	\$4,810	\$37,462	066\$	\$14,407	7.79	2.41
									ı	1
-	FEMP PROJECT 4	31,911	15,651	16,260	\$160,076	\$928,646	\$7,920	\$329,166	2.80	7.74

		- 1	11				_				
				SPB	(YK)	3.12	2.93				5.80
			TOTAL	NON-ENERGY	NON- RECURRING	\$7,984	260'2\$	\$191,341	\$108,338	\$14,407	\$329,166
		ECT 4		NON-ENERGY	ANNUAL	90	\$0	\$3,960	\$2,970		\$7.920
	<b>IARY:</b>	INFRA-RED HEAT - FEMP PROJECT 4		INVESTMENT	COST	\$78,231	\$45,837	\$503,778	\$263,339	\$37,462	\$928 646
TABLE 5.1	T SUMIN	T - FEN		1ST YEAR	SAVINGS	\$25.042	\$15,647	\$77,721	\$36,858	\$4,810	\$160.076
TA	PROJECT SUMMARY:	ED HEA		ENERGY	SAVINGS (MJ)	3.056.588	1.896,310	7.962.001	3.531.370	707,863	17 154 131
	Ъ	VFRA-R		ECO	ENERGY (MJ)	2 942 226	1.825,361	7,664,111	3 399 242	681,382	16 519 399
				BASELINE	ENERGY (MJ)	10			6 930 612		33 666 453
				BUILDING	NUMBER	5220	5253	6113-6118 6142-6147	6560-6564 6576 6577	6592	A TOTI OUG GATA
				ECO	NUMBER						

5.05 5.38 2.44 2.22 2.22

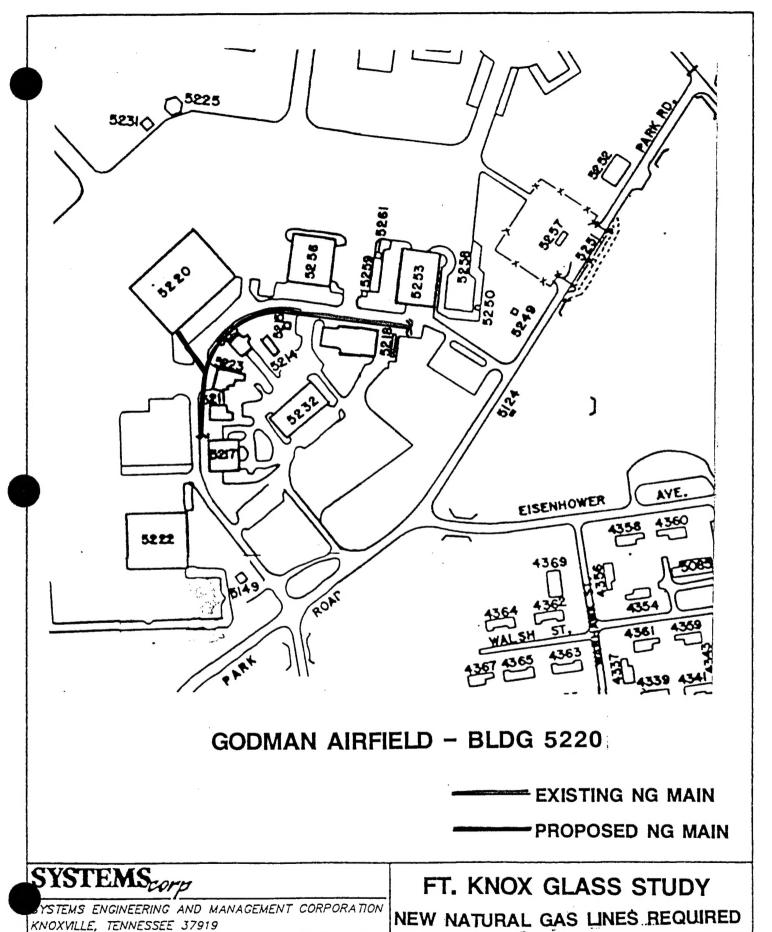
SIR

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: PRJT4
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080
INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3 PROJECT NO. & TITLE: PRJT4 FEMP PROJECT 4 - INFRARED HEAT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-26-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH A. CONSTRUCTION COST \$ 844224.

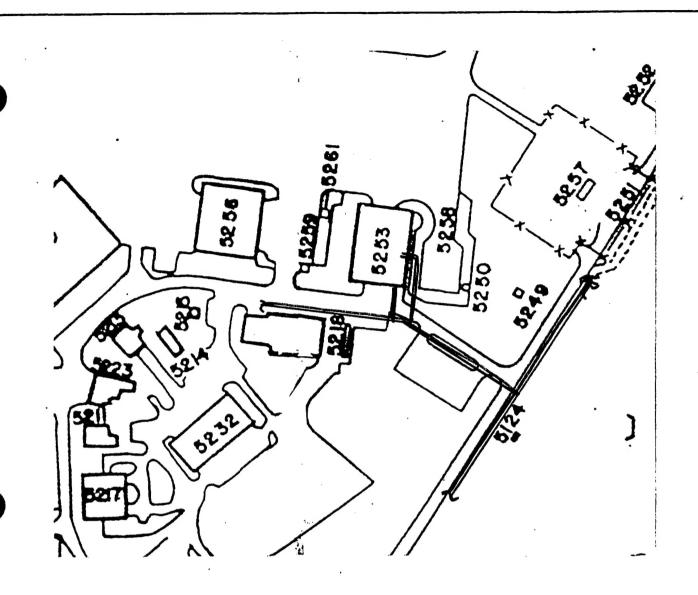
B. SIOH \$ 42211.

C. DESIGN COST \$ 42211.

D. TOTAL COST (1A+1B+1C) \$ 928646. 1. INVESTMENT E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$ 928646. G. TOTAL INVESTMENT (1D - 1E - 1F) 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNTED \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FUEL 3545781. 0. \$ -1388101. \$ 0. \$ 0. \$ 0. \$ 2157681. 3. NON ENERGY SAVINGS(+) / COST(-) 7920. A. ANNUAL RECURRING (+/-) 14.74 (1) DISCOUNT FACTOR (TABLE A) 116741. (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS (+) / COSTS (-) TINGS(+) / COSTS(-)
SAVINGS(+) YR DISCNT
COST(-) OC FACTR
(1) (2) (3) COST(-)(4)
\$ 78508. 5 .86 67517.
\$ 78508. 15 .63 49460.
\$ 9575. 7 .81 7756.
\$ 9575. 14 .65 6224.
\$ 152999. 3 .91 139229. ITEM 1. REPAIR 2. REPAIR2 3. REPAIR3 4. REPAIR4 5. ENVIR 270186. \$ 329166. d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 386927. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 160076. 5.80 YEARS 5. SIMPLE PAYBACK PERIOD (1G/4) \$ 2544608. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.74 (IF < 1 PROJECT DOES NOT QUALIFY) 8.43 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):



DRAWN BY B. YATES JOB NO. 94013.02 SHEET NO. CHECKED BY J. HOLLENSBE DATE 10-07-94 PAGE 5-4



### **GODMAN AIRFIELD - BLDG 5253**

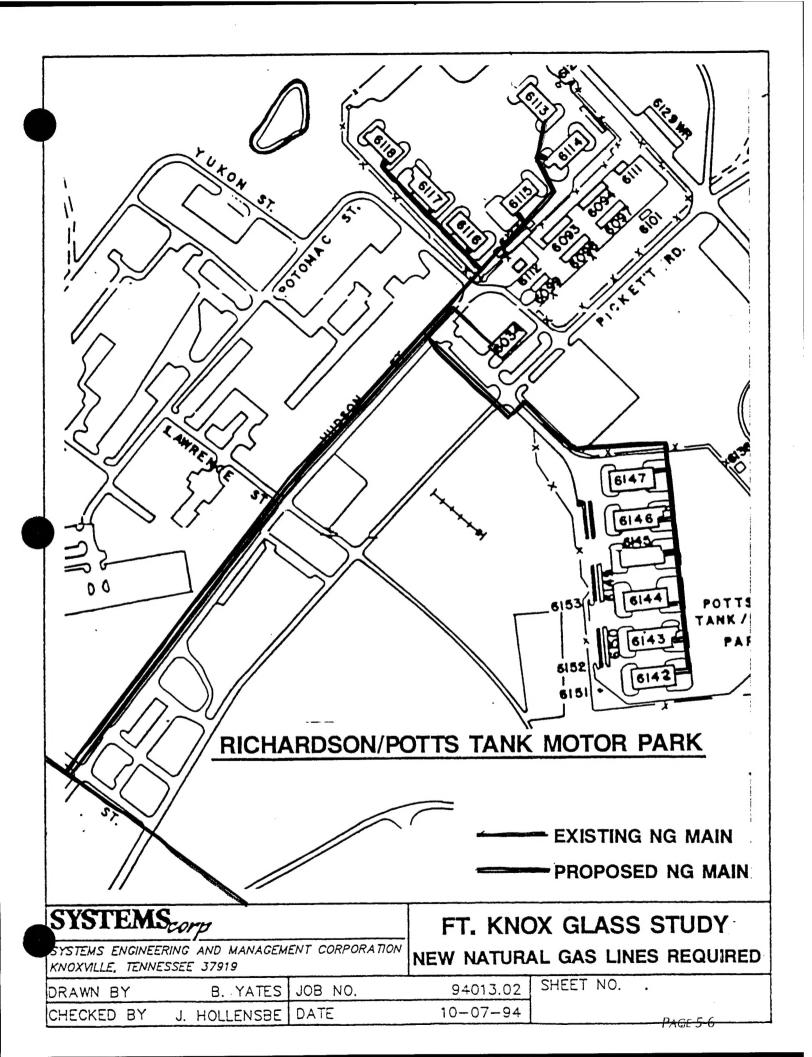
EXISTING NG MAIN

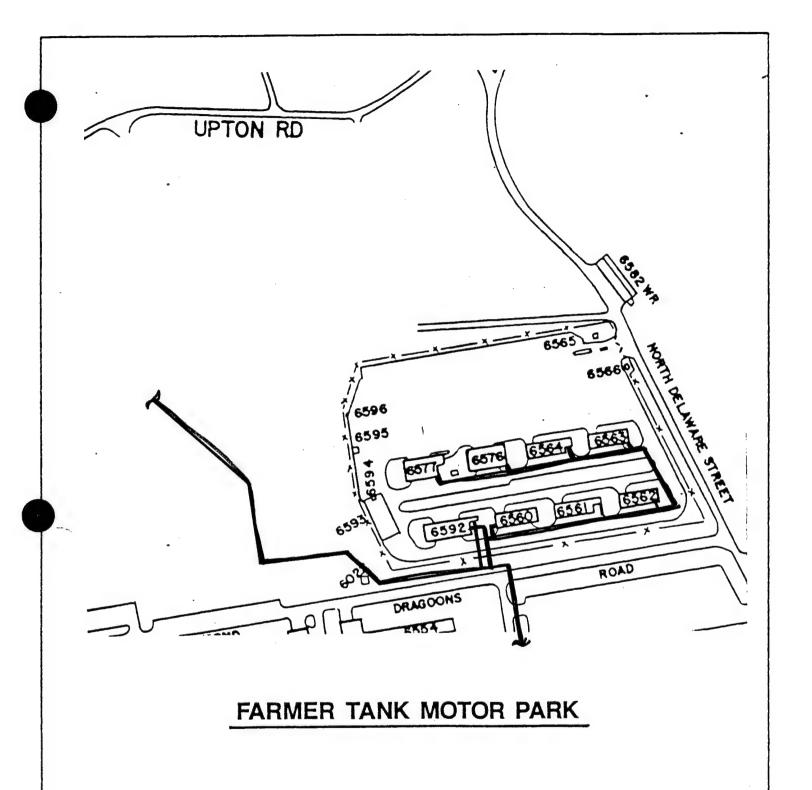
PROPOSED NG MAIN

YSTEMS ENGINEERING AND MANAGEMENT CORPORATION NOXVILLE, TENNESSEE 37919

FT. KNOX GLASS STUDY
NEW NATURAL GAS LINES REQUIRED

DRAWN BY	B. YATES	JOB NO.	94013.02	SHEET NO.
CHECKED BY	J. HOLLENSBE	DATE	10-07-94	





PROPOSED NG MAIN

SYSTEMScorp

YSTEMS ENGINEERING AND MANAGEMENT CORPORATION KNOXVILLE, TENNESSEE 37919

FT. KNOX GLASS STUDY
NEW NATURAL GAS LINES REQUIRED

DRAWN BY	B. YATES	JOB NO.	94013.02	SHEET	NO.	
CHECKED BY	J. HOLLENSBE	DATE	10-07-94			PAGE 5-7

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3 PROJECT NO. & TITLE: 5220ECO1 ECO-1 INFRARED HEAT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-26-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT A. CONSTRUCTION COST \$ 71119.
B. SIOH \$ 3556.
C. DESIGN COST \$ 3556.
D. TOTAL COST (1A+1B+1C) \$ 78231. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ F. PUBLIC UTILITY COMPANY REBATE
G. TOTAL INVESTMENT (1D - 1E - 1F) 78231. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) DISCOUNTED SAVINGS (5) 0. 0. 0. A. ELECT \$ .00 B. DIST \$ 6.60 5686. C. RESID \$ .00 0. 15.61 658985. 37528. 17.56 \$ .0. \$ -12885. \$ 0. \$ 0. \$ 24642. 0. 19.97 \$ -270073. \$ 0. \$ 0. \$ 0. \$ 388911. 20.96 D. NAT.G \$ 4.62 17.58 0. E. COAL \$ .00 F. LPG \$ .00 16.12 0. 14.74 M. DEMAND SAVINGS 2897. N. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) 14.74 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT DISCOUNTED
COST(-) OC FACTR SAVINGS(+)/ ITEM (1) (2) (3) 3992. 5 .86 3992. 15 .63 COST(-)(4)3433. 1. REPAIR 2515. 2. REPAIR2 5948. \$ 7984. · d. TOTAL C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 5948. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 25042. 3.12 YEARS 5. SIMPLE PAYBACK PERIOD (1G/4) \$ 394859. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) (SIR) = (6 / 1G) =5.05 7. SAVINGS TO INVESTMENT RATIO (IF < 1 PROJECT DOES NOT QUALIFY) 11.79 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

LIFE CYCLE COST ANALYSIS SUMMARY

STUDY: 5220ECO1 LCCID 1.080

# **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAG	PAGE 1 OF 3
BUILDING NUMBER:	5220		BUILDING H OUTSIDE DI TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE URE	68 1 67	<u> </u>		
INFILTRATION LOSSES =	-	AIR CHGS X	965210	VOL (CUFT) X	29	F TEMP DIFF X 0.019	11	1.23	MBTU / HR
FLOOR LOSSES =	820	LINEAR F	LINEAR FEET OF PERIMETER	IMETER X	29	F TEMP DIFF X 0.81	II	0.04	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	33773	33773 AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.24	MBTU / HR
8" RED BRICK WALL =	6467	AREA (SF) X	0.14	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
8" CINDER BLOCK WALL =		AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	n.	0.00	MBTU / HR
CORR MTL PNL WALL =	5763	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.07	MBTU / HR
CLR SGL PANE WINDOWS =	4301	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE 'DIFFERENCE	11	0.36	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	0.65	U VALUE (BTU/ HR-SF-F) X.	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR =	1764	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	n	0.07	MBTU / HR
METAL PERSONNEL DR =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	100	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
		ı							

MBTU / HR MJ/HR

2.06 2,176.78

n n

**TOTAL BASELINE HEAT LOSSES** 

# ECO - 1: INFRARED HEATING CALCULATIONS

				-				PAGE 2 OF	2 OF 3
BUILDING NUMBER:	5220		BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATURE URE	55 1 54	<u> </u>		
INFILTRATION LOSSES =	_	AIR CHGS X	965210	VOL (CUFT) X	54 F	F TEMP DIFF X 0.019	11	0.99	MBTU / HR
FLOOR LOSSES =	820	LINEAR F	EET OF P	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	11	0.04	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	33773	33773 AREA (SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.19	MBTU / HR
8" RED BRICK WALL =	6467	AREA (SF) X	0.14	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.05	MBTU / HR
8" CINDER BLOCK WALL =	0	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
CORR MTL PNL WALL =	5763	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
CLR SGL PANE WINDOWS =	4301	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	n	0.29	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
METAL ROLL UP DOORS =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
METAL GLAZED O'HEAD DR =	0	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR =	1764	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
METAL PERSONNEL DR =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	100	AREA (SF) X	( 0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR

MBTU / HR MJ/HR

1.66 1,754.42

n n

TOTAL ECO HEAT LOSSES

**ECO - 1: INFRARED HEATING CALCULATIONS** 

PAGE 3 OF 3

	BASELINE	ECO - 1	BUILDING N
SYSTEM EFFICIENCY	%09	%06	
OUTSIDE DESIGN TEMP (F)	-	-	1 MBTU = 1055
HTG TEMP SETPOINT (F)	89	55	0.019=CONSTA
HEATING DEGREE DAYS	4616	3396	.81 = CONSTAN
TOTAL HEAT LOSSES	2.06	1.66	CORR FACTOR
(MBTU / HR)	2		65 F DEGREE-I
\$ /MBTU -FUEL OIL	\$6.60	\$6.60	
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62	
\$ /MBTU -PPG	\$10.84	\$10.84	

<b>BUILDING NUMBER</b>	5220
	GLOSSARY OF TERMS
1 MBTU = 1055 MJ	
0.019=CONSTANT	0.019=CONSTANT
.81 = CONSTANT FOR SE	AB PERIMETER UNINGCLATED TROMINGTON
CORR FACTOR = EMPI	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR THE STATE OF THE STATE O
65 F DEGREE-DAYS FRC	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

4	ANNUAL HEA	TING ENERG	3Y C	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	DEGREE D	ΑX	METHOL	(0	
BASELINE≈	2.06	MBTU/HR X 'SYS EFF X	4616	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 67 TEMP DIFFERENCE	HRS/DAY	11	5,686.08	MBTU/YR	
	5,686.08	MBTU/YR	×	CORR FACTOR 1		Ħ		5,686.08	MBTUMR
ECO - 1 =	1.66	MBTU/HR X	3396	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY	HRS/DAY	11	2.788.84	MBTU/YR	
	2.788.84	MBTU/YR	ţ ×	CORR FACTOR 1		n	1	2,788.84	MBTUMR
	ECO - 1 ANNU	ANNUAL HEATIF	NG EN	AL HEATING ENERGY CONSUMPTION SAVINGS	N SAVINGS	11 11		2,897.24 3,056,590.86	MBTU/YR

	ANNOAL	ANNUAL HEATING ENERGY COST	NERGY	COSI			
BASELINE =	5,686.08	MBTU/YR X 6.6	6.6	\$ /MBTU	н	37,528.16 \$ MR	\$ MR
ECO - 1 =	2,788.84	MBTU / YR X 4.62	4.62	\$ /MBTU	n	12,884.45 \$ MR	<b>\$</b> ∀R
	INDA 4 ONN	ECO 4 ANNITAL HEATING ENERGY COST SAVINGS = 24,643.71 \$ MR	:NFRGY C	OST SAVINGS	11	24,643.71	\$ MR

			=======================================		=======
Estimate: Description: Project: Location: Sq. footage:	BLDG 5220 COST ESTIMATE LIMITED EEAP(GI FORT KNOX, KY *******		14-Oct-94 e: 94013.02 dx:Louisville,	KY ========	
Line #	Description				
	Manhours Mat	Labor	- Equipment	Sub .	Total
=======================================					
0205541750	PAVEMENT REMOVA			8.00 S.	Υ.
Unit values Totals		.00 2.0 \$0 \$3	)9 3.02 L7 \$24		5.11 \$41
0205543200	SITE REMOVAL,S	TEEL PIPE, W	ELDED CONNECTI	ON, 550.00 L.	F.
Unit values Totals	0.15 0 82.50	.00 3. \$0 \$1,7	1.29 36 \$707	0.00	4.44
0207183600	HVAC DEMO, MECH	EQPT HEAVY	ITEM	2.00 To	on
Unit values Totals	14.55 0 29.09		36 0.00 51 \$0	0.00	380.36
0208400600	REMOVE PIPE IN	SULATION UP	TO 4" DIAMETE	ER PIPE 300.00 L	.F.
Unit values Totals	0.07 0 21.30	.00 1. \$0 \$5	97 0.24 92 \$71	0.00	2.21
0208401000	REMOVE INSULAT			TOO.OO E	
Unit values Totals	0.20 0 20.00	.00 5. \$0 \$5	55 0.68 55 \$68	0.00	6.23 \$623
0222541900	TAMPING TRENCH	B'FILL, VI	BRATING PLATE	, ADD 11.00 C	.Y.
Unit values Totals			74 0.67 19 \$7	0.00	2.41 \$26
0222582800	TRENCH EXCVTNG	40HP CHNTR	NCHR&BKFL 12"	W24"D 140.00 L	.F.
Unit values Totals	0.01 0 1.40	.00 0. \$0 \$	24 0.24 33 \$33	0.00	0.47
0251040380	ASPHALTIC CONC	RETE PAVEME	NT, PAVING, W	EARING 8.00 S	.Y.
Unit values Totals	0.02 1	.90 0.	33 0.30 \$3 \$2	0.00	2.53 \$20

21-0ct-94		MeansDa	ta for Lotu	ıs		Page 2
260120200	BEDDING, FOR	PIPE IN	TRENCH SAN	ID, DEAD OR	3.00 C.Y	
Unit values Totals	0.16 0.48	2.43 \$7	3.37 \$10	1.37 · \$4	0.00 \$0	7.17 \$21
0260120500	BEDDING, PLA	ACING IN	TRENCH		3.00 C.Y	7.
Unit values Totals	0.09 0.27	0.00 \$0	1.74 \$5	0.67 \$2	0.00 \$0	2.41 \$7
0266907800	CUT IN VALVI	es, W/DUC	CK TIP GASKI	ET, 4" DIAM	ETER 1.00 Ea.	
Unit values Totals	1.56 1.56	259.60 \$260	35.47 \$35	5.91 \$6		300.98 \$301
0268520200	GAS SERVICE PSI 2" DIAM	& DISTR	B PIPING, PO	OLYETHYLENE	,60- 140.00 L.E	₹.
Unit values Totals	0.07 9.38	0.75	1.48 \$207	0.00 \$0	0.00	2.23 \$312
0268520600	GAS SERVICE END, TAR COA	&DISTRIB F&WRAP 2	"DIAM		150.00 Б.1	
Unit values Totals	0.11 17.10	2.19 \$328	3.18 \$476	0.19 \$28	0.00 \$0	5.55 \$832

=============	=======	======				
Line #	Descriptio	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======	=======				
U02 SITEWORK	185	\$715	\$4,449	\$952	\$0	\$6,116
1554510245	HTG INFA-R	D UNT GAS	ELEC IG	4	1.00	LS
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0		52476.00 \$52,476
1562600137	GAS APPLIA TYPE 1-1/4	NCE REGUL	ATORS DO	UBLE DIAPHR	AGM 1.00	Ea.
Unit values Totals	0.53 0.53	226.00 \$226	12.10 \$12	0.00	0.00 \$0	238.10 \$238
1562600139	GAS APPLIA	NCE REGUL PE SIZE	ATORS DO	UBLE DIAPHE	RAGM 1.00	Ea.
Unit values Totals	0.73 0.73	420.00 \$420	16.42 \$16			436.42 \$436
U15 MECHANICAL	2	\$646	\$28	\$0	\$52,476	\$53,150

_=========	========	========				========
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======================================	=========	======	========		
ESTIMATE TOTAL	<u> </u>	\$1,361	\$4,477	\$952	\$52,476	\$59,266
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
	CONTINGENC 10.00% 0.00% 10.00%	\$1,361	\$4,477	\$952	\$52,476	\$59,266 \$5,927 \$0 \$5,927
JOB TOTAL						\$71,119

Estimate: BLDG 5220 Date:
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date: Date: 14-Oct-94

Location:

FORT KNOX, KY Job #: 94013.02

Sq. footage:	*****	· · · · · · · · · · · · · · · · · · ·	City indx	:Louisville =======	, RI ========	=======
==========	Si	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======	======	=======	========		
U02 SITEWORK U15 MECHANICAL	185 2	\$715 \$646	\$4,449° \$28	\$952 \$0	\$0 \$52,476	\$6,116 \$53,150
TOTAL	187	\$1,361	\$4,477	\$952 ·	\$52,476	\$59,266
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	CONTINGENC 10.00% 0.00% 10.00%	\$1,361	\$4,477	\$952	\$52,476	\$59,266 \$5,927 \$0 \$5,927
JOB TOTAL						\$71,119

Estimate: BLDG 5220 Date: 14-Oct-94 Description: INFRARED HEATING SYSTEM COST ESTIMATE LIMITED EEAP(GLASSBid Date: Project: Location: 94013.02 FORT KNOX, KY Job #: City indx:Louisville, KY Sq. footage: Description \_\_\_\_\_ Labor Equipment Sub Total Manhours Matl 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 1000.00 L.F. AND RECEPTACLES 6.79 0.00 0.00 4.57 2.22 0.15 Unit values \$4,572 \$0 \$6,788 \$0 \$2,216 149.00 Totals \$0 \$0 \$6,788 \$2,216 \$4,572 A09 ELECTRICAL 149

	=======	========	=======			
Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
1517010650	BLACK STE			CHEDULE 40,	1000.00	L.F.
Unit values Totals	0.44	4.17 \$4,170	10.30	0.00 \$0	0.00 \$0	14.47 \$14,472
1517011310	FOR CVRG	10'0C 1/2"	DIAM	SCH 40 THRI	1000.00	L.F.
Unit values Totals	0.13 127.00	1.64	2.88	0.00 \$0	0.00 \$0	4.52 \$4,516
1519010320	ALUMINUM	REFLECTORS	W/HANGEF	RS ·	141.00	Ea.
Unit values Totals	0.50 70.50	39.79 \$5,610	3.80 \$536	0.00 \$0		43.59 \$6,146
1524105040	VACUUM PU	MP AND VEN	T PIPING		4.00	Ea.
Unit values Totals	3.00 12.00	738.35 \$2,953	120.15 \$481	0.00 \$0		858.50
1552301020	CRV- B12	GAS FIRED	BURNER 12	O MBH & CO	MBUSTION 16.00	CHAMBER
Unit values Totals	1.00	900.00 \$14,400	44.06 \$705	0.00 \$0	0.00	
1574205220	ELECTRIC	THERMOSTAT	W/ COVER	R AND WIRING	4.00	Ea.
Unit values Totals	1.00 4.00	75.00 \$300	27.55 \$110			102.55
U15 MECHANICAL	674	\$29,073	\$15,010	\$0	; \$0	\$44,083

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======		======			
1631200100	HEATING S	YSTEM POWI	ER / CONTI	ROL PANEL	4.00	Ea
Unit values Totals	2.96 11.85	330.76 \$1,323	70.58 \$282	0.00 \$0	0.00	401.34 \$1,605
U16 ELECTRICAL	12	\$1,323	\$282	\$0	\$0	\$1,605

==========	=======	=======		=========	========	=======
Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======		=======	=======	=======	
ESTIMATE TOTAL	835	\$32,612	\$19,864	\$0	\$0	\$52,476
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$O	\$0	; · \$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$32,612	\$19,864	<b>\$</b> 0	\$0	\$52,476 \$0 \$0 \$0
JOB TOTAL						\$52,476

Estimate: BLDG 5220

14-Oct-94 Date: Description: INFRARED HEATING SYSTEM COST ESTIMATE Project: LIMITED EEAP(GLASSBID Date:

JOB TOTAL

FORT KNOX, KY

Location:

Job #: 94013.02 City indx:Louisville, KY Job #:

Sq. footage:					========	
=======================================	S	UMMARY		·		
	Manhours	Matl	Labor	Equipment	Sub	Total
=========	=======	=======	=======	========		
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	149 674 12	\$2,216 \$29,073 \$1,323	\$4,572 \$15,010 \$282	\$0 \$0 \$0	\$0 \$0 \$	\$6,788 \$44,083 \$1,605
TOTAL	835	\$32,612	\$19,864	\$0	\$0	\$52,476
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$32,612	\$19,864	\$0	\$0	\$52,476 \$0 \$0 \$0

\$52,476

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3 PROJECT NO. & TITLE: 5253ECO1 ECO-1 INFRARED HEAT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-26-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT A. CONSTRUCTION COST \$ 41670.

B. SIOH \$ 2084.

C. DESIGN COST \$ 2084.

D. TOTAL COST (1A+1B+1C) \$ 45837. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) 0. 0. 45837. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) 408881. \$ 408881. \$ 0. \$ -167525. \$ 0. \$ 0. \$ 241356. 3. NON ENERGY SAVINGS(+) / COST(-) \$ 14.74 \$ 0. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A) (2) DISCOUNTED SAVING/COST (3A X 3A1) 0. B. NON RECURRING SAVINGS(+) / COSTS(-) RECURRING SAVINGS(+) / COSTS(-)

SAVINGS(+) YR DISCNT DISCOUNTED

ITEM COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4)

PAIR \$ 3548. 5 .86 3052.

PAIR2 \$ 3548. 15 .63 2235. 1. REPAIR 2. REPAIR2 d. TOTAL \$ 7097. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 5287. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 15647. 2.93 YEARS 5. SIMPLE PAYBACK PERIOD (1G/4) \$ 246643. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = (IF < 1 PROJECT DOES NOT QUALIFY) 5.38 12.15 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

	ш	T KNOX	LIMIT	FT KNOX LIMITED EEAP (GLASS)	9	LASS)			
	E	:0 - 1: INFF	RARED	ECO - 1: INFRARED HEATING CALCULATIONS	rcn	LATIONS			
		-				-		PAGE 1 OF	1 OF 3
BUILDING NUMBER:	5253		BUILDING H OUTSIDE DI TEMPERATI	BUILDING HEATING TEMPERATURE SETPOINT OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE JRE	60			
INFILTRATION LOSSES =	-	AIR CHGS X	411840	VOL (CUFT) X	59 F	F TEMP DIFF X 0.019	II	0.46	MBTU / HR
FLOOR LOSSES=	504	LINEAR FE	LINEAR FEET OF PERIMETER	IMETER X	59 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES									
FLAT BUILT UP ROOF =	14976	AREA (SF) X	0.207	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.18	MBTU / HR
8" RED BRICK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	7559	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	0.17	MBTU / HR
CORR MTL PNL WALL =	1696	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	2968	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	п	0.22	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE . DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	ti	0.00	MBTU / HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
LG MTL SLIDING DOOR =	1568	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	н	0.05	MBTU / HR
METAL PERSONNEL DR =		AREA(SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	П	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=		AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	li l	00.00	MBTU / HR

<u>[</u>

MBTU / HR MJ/HR

1.13 1,189.23

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TOTAL BASELINE HEAT LOSSES

# **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 2 OF 3		MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	
PAG		0.42	0.02	0.17	00.00	0.16	0.02	0.20	0.00	0.00	0.00	0.05	0.00	0.00	
	<u> ս և և</u>	11	H	н	н	Н	н	11	II	II	11	В	H	11	
	JRE SETPOINT: 55 F	F TEMP DIFF X 0.019	F TEMP DIFF X 0.81	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE					
	RATUR ATUR SE	54	54	54	54	54	54	54	54	54	54	54	54	54	
	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	VOL (CUFT) X	LINEAR FEET OF PERIMETER X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	
	BUILDING OUTSIDE TEMPER	411840	ET OF P	0.207	0.176	0.389	0.17	1.235	0.65	0.56	0.214	0.56	0.56	0.615	
		×	R FE	×	×	×	×	×	×	×	×	×	×	×	
		AIR CHGS	LINEA	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF) X	
	5253	-	504	14976	0	7559	1696	2968	0	0	0	1568	0	Ο.	
	BUILDING NUMBER:	INFILTRATION LOSSES =	FLOOR LOSSES =	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8" RED BRICK WALL =	8" CINDER BLOCK WALL =	CORR MTL PNL WALL =	CLR SGL PANE WINDOWS =	TINTED DBL PANE WIN'W =	METAL ROLL UP DOORS =	METAL GLAZED O'HEAD DR =	LG MTL SLIDING DOOR =	METAL PERSONNEL DR =	MTL/ GLAZED PERSONNEL=	

MBTU / HR MJ/HR

1.03 1,088.44

11 11

**TOTAL ECO HEAT LOSSES** 

### **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 3 OF 3

	BASELINE	ECO - 1	BUILDING NU
SYSTEM EFFICIENCY	%09	%06	
OUTSIDE DESIGN TEMP (F)	τ-	-	1 MBTU = 1055 N
HTG TEMP SETPOINT (F)	09	55	0.019=CONSTAN
HEATING DEGREE DAYS	4616	3396	.81 = CONSTAN
TOTAL HEAT LOSSES	7	1 03	CORR FACTOR
(MBTU / HR)	2	2	65 F DEGREE-D
\$ /MBTU -FUEL OIL	\$6.60	\$6.60	
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62	
\$ /MBTU -PPG	\$10.84	\$10.84	

		E FFECT VS	
	ERMS	SULATED FROM ASHRAI FACTOR FOR HEATING E ENTALS 1989 PG28.2	
5253	GLOSSARY OF TERMS	AB PERIMETER UNINS SICAL CORRECTION F M ASHRAE FUNDAME	
<b>BUILDING NUMBER</b>		1 MBTU = 1055 MJ 0.019=CONSTANT .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	

4	ANNUAL HEATIN	TING ENERGY C	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	DAY MET	НОД)	
BASELINE≈	1.13	MBTU / HR X 4616	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY			
	9.0	SYS EFF X 59	TEMP DIFFERENCE	= 3,527.65	35 MBTU/YR	
	3,527.65	MBTU/YR X	CORR FACTOR 1	11	3,527.65	MBTU/YR
ECO - 1 =	1.03	MBTU/HR X 3396	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY		•	
	6.0	SYS EFF X 54 TEMP DIFFERENCE	TEMP DIFFERENCE	= 1,730.20	20 MBTU/YR	
	1,730.20	MBTU/YR X	CORR FACTOR 1	II	1,730.20	MBTU/YR
	ECO - 1 ANNI	ANNUAL HEATING E	UAL HEATING ENERGY CONSUMPTION SAVINGS	11 11	1,797.45	MBTU/YR MJ/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST			
BASELINE =	3,527.65	MBTU/YR X 6.6	6.6	\$ /MBTU	11	23,282.50 \$ MR	\$ YR
ECO - 1=	1,730.20	MBTU/YR X 4.62	4.62	\$ /MBTU	ıı '	7,993.52 \$ /YR	* // R
	ECO. 1 ANIMI	IAI HEATINGE	NFRGY (	ECO_1 ANNIAL HEATING ENERGY COST SAVINGS = 15.288.97 \$ /YR	U	15.288.97	S ∧R

14-Oct-94 Date: BLDG 5253 Estimate: COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: 94013.02 FORT KNOX, KY Job #: Location: City indx:Louisville, KY \*\*\*\*\* Sq. footage: . Description Line # Equipment Sub Labor Matl Manhours PAVEMENT REMOVAL, BITUMINOUS, 4" TO 6" THICK 0205541750 8.00 S.Y. 3.02 0.00 5.11 2.09 0.00 Unit values 0.10 \$24 \$0 \$41 \$17 0.76 \$0 Totals SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 350.00 L.F. 4"DIAMETER 1.29 0.00 4.44 0.00 3.16 Unit values 0.15 \$0 \$450 \$1,555 52.50 \$0 \$1,105 Totals HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 2.00 Ton 0.00 0.00 380.36 0.00 380.36 14.55 Unit values \$761 \$0 \$0 \$761 \$0 29.09 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 300.00 L.F. 2.21 1.97 0.24 0.00 0.00 Unit values 0.07 \$0 \$663 \$592 \$71 Totals 21.30 \$0 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 100.00 Ea. DIAMETER PIPE 5.55 0.68 0.00 6.23 0.00 0.20 Unit values \$68 \$0 \$623 20.00 \$0 \$555 Totals TAMPING TRENCH B'FILL, VIBRATING PLATE, ADD 0222541900 11.00 C.Y. 1.74 0.67 0.00 2.41 0.00 0.09 Unit values \$0 \$26 \$7 \$0 \$19 0.98 Totals TRENCH EXCVTNG 40HP CHNTRNCHR&BKFL 12"W24"D 0222582800 70.00 L.F. 0.24 0.24 0.00 0.00 Unit values 0.01 \$34 \$17 \$0 \$17 0.70 \$0 Totals ASPHALTIC CONCRETE PAVEMENT, PAVING, WEARING 0251040380 8.00 S.Y. COURSE, 2" THICK 0.33 0.30 0.00 2.53 0.02 1.90 Unit values \$2 \$0 \$20 \$15 \$3 0.12 Totals

0260120200	BEDDING, BANK	FOR PIPE IN	TRENCH SA	ND, DEAD O	R 3.00 C.Y	
Unit values Totals		2.43 \$7	3.37 \$10	1.37 \$4	0.00	7.17 \$21
0260120500	BEDDING,	PLACING IN	TRENCH		3 00 G V	
Unit values Totals	0.09 0.27	0.00 \$0	1.74 \$5	0.67 \$2	3.00 C.Y 0.00 \$0	2.41 \$7
0266907800	CUT IN V	ALVES, W/DUC	K TIP GASK	ET, 4" DIA	METER 1.00 Ea.	
Unit values Totals	1.56 1.56	259.60 \$260	35.47 \$35	5.91 \$6		300.98 \$301
0268520200		CE & DISTRI				
Unit values Totals	0.07 4.69		1.48	0.00	70.00 L.F 0.00 \$0	
0268520600		CE&DISTRIB		40 STEEL P	LAIN	
Unit values Totals	0.11	COAT&WRAP 2" 2.19 \$219	3.18	0.19 \$19	100.00 L.F 0.00 \$0	5.55 \$556

Line #	Descriptio	n				
nine #	Manhours		Labor	Equipment	Sub	Total
=======================================	=========	=======	========		.=======	
U02 SITEWORK	144	\$554	\$3,541	\$670	\$0	\$4,765
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	1		
Unit values Totals	0.00	0.00 \$0	0.00	0.00		29286.00 \$29,286
1562600137	GAS APPLIA			JBLE DIAPHF		7-
Unit values Totals	TYPE 1-1/4 0.53 0.53		ZE 12.10 \$12	0.00	1.00 0.00 \$0	238.10
1562600139	GAS APPLIA		ATORS DOU	JBLE DIAPHF		-
Unit values Totals	TYPE 2" PI 0.73 0.73	PE SIZE 420.00 \$420	16.42 \$16	0.00 \$0		
U15 MECHANICAL	2	\$646	\$28	\$0	\$29,286	\$29,960

=======================================	========		=======	=======		
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
===========	:=======	=======	======	_ = = = = = = = = = = =		
ESTIMATE TOTAL	J 146	\$1,200	\$3,569	\$670	\$29,286	\$34,725
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0		
SUB MARKUP  TOTAL BEFORE C  CONTINGENCY  BOND	0.00% CONTINGENC 10.00% 0.00%	\$1,200	\$3,569	\$670	\$0 \$29,286	\$34,725 \$3,473 \$0
PROFIT	10.00%					\$3,473
JOB TOTAL						\$41,670

Estimate: BLDG 5253 Date: 14-Oct-94
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBID Date:

Project: Location:

JOB TOTAL

FORT KNOX, KY Job #: 94013.02

Sq. footage:

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City indx:Louisville, KY

sq. rootage.						
	S	JMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	=======	======	========		
U02 SITEWORK U15 MECHANICAL	144 2	\$554 \$646	\$3,541 \$28	\$670 \$0	\$0 \$29,286	\$4,765 \$29,960
TOTAL	146	\$1,200	\$3,569	\$670	\$29,286	\$34,725
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
•	0.00% ONTINGENC 10.00% 0.00% 10.00%	\$1,200	\$3,569	\$670	\$29,286	\$34,725 \$3,473 \$0 \$3,473

\$41,670

Estimate: BLDG 5253 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: Project: LIMITED EEAP(GLASSBid Date: FORT KNOX, KY Job #: Location: City indx:Louisville, KY Sq. footage: Description \_\_\_\_\_\_ Manhours Matl Labor Equipment Sub . Total 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 450.00 L.F. AND RECEPTACLES 4.57 0.00 0.15 0.00 2.22 Unit values \$0 \$0 Totals 67.05 \$997 \$2,058 \$3,055 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES 140.00 L.F. 2.22 4.57 0.00 0.00 6.79 Unit values 0.15 Totals 20.86 \$310 \$640 \$0 \$0 \$950 \$1,307 \$2,698 \$0 \$4,005 \$0 A09 ELECTRICAL 88

	=======	=======				
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======	=======	======			
1517010650	W/CDI.CS			CHEDULE 40,	500.00	L.F.
Unit values Totals	0.44	4.17 \$2,085	10.30 \$5,151	0.00 \$0	0.00 \$0	14.47 \$7,236
1517011310			T T T 1 1 4			T 17
Unit values Totals	0.13	1.64	2.88	0.00 \$0	0.00	4.52 \$2,890
1519010320	ALUMINUM 1	REFLECTORS	W/HANGE	RS	66.00	E o
Unit values Totals	0.50 33.00	39.79 \$2,626	3.80 \$251	0.00 \$0	0.00	43.59
1524105040	VACUUM PUI	MP AND VEN	T PIPING		2.00	E-2
Unit values Totals	3.00 6.00	738.35 \$1,477	120.15 \$240	0.00 \$0	0.00	858.50 \$1,717
1552301020	CRV - B12	GAS FIRED	BURNER	120 MBH &	COMBUSTION 6.00	N CHAMBER
Unit values Totals	1.00	900.00 \$5,400	44.06 \$264	0.00 \$0	0.00	944.06 \$5,664
1554510160	CO RAY-VA	C VANTAGE	2 INFA-	RD HTG UNT,	GAS 60MB	H
Unit values Totals	4.00	420.00 \$2,520	81.70 \$490	0.00 \$0	0.00	501.70
1556800120	CO-RAY-VA	C VANTAGE	2 VENT C	HIMNEY	6.00	Pa
Unit values Totals	1.60 9.60	70.00 \$420	76.50 \$459	0.00 \$0	0.00	146.50
1574205220	ELECTRIC '	THERMOSTAT	W/ COVE	R AND WIRIN		E o
Unit values Totals	1.00	75.00 \$150	27.55 \$55		2.00 0.00 \$0	102.55
U15 MECHANICAL	384	\$15,728	\$8,750	<i>,</i> \$0	\$0	\$24,478

		========	=======	========	=======	========
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
22222222222	=======	=======	:=======			
1631200100	HEATING SY	STEM POWE	ER / CONTR	OL PANEL	2.00	Ea.
Unit values Totals	2.96 5.93	330.76 \$662	70.58 \$141	0.00 \$0	0.00	401.34 \$803
U16 ELECTRICAL	6	\$662	\$141	\$0	\$0	\$803

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Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======	========	= = = = = = :	=======		
ESTIMATE TOTAL	478	\$17,697	\$11,589	\$0	\$0	\$29,286
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		γv	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$17,697	\$11,589	\$0	\$0	\$29,286 \$0 \$0 \$0
JOB TOTAL						\$29,286

\_\_\_\_\_\_

Estimate: Description:

Date: 14-Oct-94 BLDG 5253 INFRARED HEATING SYSTEM COST ESTIMATE

Project: Location: LIMITED EEAP (GLASSBid Date: FORT KNOX, KY Job #:

Sa footage:

94013.02 City indx:Louisville, KY

Sq.	rootage:			city indx		, =======	
===	========	======= S	UMMARY				
		Manhours	Matl	Labor	Equipment	Sub	Total
===	=======	=======	=======	======			
A09 U15 U16	MECHANICAL	88 384 6	\$1,307 \$15,728 \$662	\$2,698 \$8,750 \$141	\$0 \$0 \$0	\$0 \$0 \$0	\$4,005 \$24,478 \$803
TOT	AL	478	\$17,697	\$11,589	. \$0	\$0	\$29,286
MAT	ES TAX L MARKUP OR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQU	IPT MARKUP MARKUP	0.00%		4.0	\$0	\$0	
	TINGENCY D	ONTINGENC 0.00% 0.00% 0.00%	\$17,697	\$11,589	\$0	\$0	\$29,286 \$0 \$0 \$0
JOB	TOTAL						\$29,286

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3 PROJECT NO. & TITLE: 6113ECO1 ECO-1 INFRARED HEAT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-18-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT 1. INVESTMENT
A. CONSTRUCTION COST \$ 457980.
B. SIOH \$ 22899.
C. DESIGN COST \$ 22899.
D. TOTAL COST (1A+1B+1C) \$ 503778. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0.

F. PUBLIC UTILITY COMPANY REBATE \$ 0.

G. TOTAL INVESTMENT (1D - 1E - 1F) 503778. 2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNTED FUEL \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) A. ELECT \$ .00 0. \$ 0. 15.61 \$ 0. B. DIST \$ 6.60 14811. \$ 97756. 17.56 \$ 1716591. C. RESID \$ .00 0. \$ 0. 19.97 \$ 0. D. NAT G \$ 4.62 -7265. \$ -33562. 20.96 \$ -703465. E. COAL \$ .00 0. \$ 0. 17.58 \$ 0. F. LPG \$ .00 0. \$ 0. 17.58 \$ 0. M. DEMAND SAVINGS \$ 0. 16.12 \$ 0. M. DEMAND SAVINGS \$ 0. 14.74 \$ 0. N. TOTAL 7547. \$ 64194. \$ 1013126. 3. NON ENERGY SAVINGS(+) / COST(-) ANNUAL RECURRING (+/-) \$ 3960.

(1) DISCOUNT FACTOR (TABLE A) 14.74

(2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 58370. (1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVING (2007) A. ANNUAL RECURRING (+/-) (2) DISCOUNTED SAVINGS (+) / COSTS (-)

B. NON RECURRING SAVINGS (+) / COSTS (-)

SAVINGS (+) YR DISCNT DISCOUNTED

COST (-) OC FACTR SAVINGS (+) /

(1) (2) (3) COST (-) (4)

1. REPAIR \$ 47903. 5 .86 41197.

2. REPAIR2 \$ 47903. 15 .63 30179.

3. REPAIR3 \$ 3636. 7 .81 2945.

4. REPAIR4 \$ 3636. 14 .65 2364.

5. ENVIR \$ 88261. 3 .91 80318. d. TOTAL \$ 191341. 157003. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 215373. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 77721. 5. SIMPLE PAYBACK PERIOD (1G/4) 6.48 YEARS 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 1228500. 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.44 (IF < 1 PROJECT DOES NOT QUALIFY) 7.80 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

Estimate:	61XX AREA	Da	te: 0	======================================		
Description: Project: Location: Sq. footage:	MAIN GAS I	INE LA	LV INGX:D	Outpatte.	KY	
Line #	Description					
	Manhours	Matl	Labor E	quipment	Sub	Total
0222541900	TAMPING TR	ENCH B'FIL	L, VIBRAT	ING PLATE,	ADD 122.50	C.Y.
Unit values Totals	0.09 10.90	0.00	1.74 \$213	0.67 \$82	0.00	
0222582800						L.F.
Unit values Totals	0.01 16.50	0.00	0.24 \$390	0.24 \$390	0.00	0.47
0260120200	BEDDING, FOR	OR PIPE IN	TRENCH S	AND, DEAD	OR 31.00	C.Y.
Unit values Totals	0.16 4.96	2.43 \$75	3.37 \$105	1.37 \$42	0.00	
0260120500	BEDDING, P	LACING IN	TRENCH		31.00	C V
Unit values Totals	0.09 2.76	0.00 \$0		0.67 \$21	0.00	2.41
0266907800	CUT IN VAL	VES, W/DUC	K TIP GAS	KET, 4" DI	AMETER 1.00	T-2
Unit values Totals	1.56 1.56	259.60 \$260	35.47 \$35	5.91 \$6	0.00	300.98 \$301
0268520350	GAS SERVICE SI 4"DIA, SE	E & DISTRI	B PIPINGP	OLYETHYLENI	E,60P- 1650.00	ਜ . ਜ
Unit values Totals	0.11 178.20	2.43 \$4,016	2.45 \$4,037	0.41 \$678	0.00	5.29 \$8,731
U02 SITEWORK	215	\$4,351	\$4,834	\$1,219	\$0	\$10,404
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Line #	Descripti	lon				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
1562600142		ANCE REGUL	ATORS DOU	BLE DIAPHRAG	3M 1.00	Fa
Unit values Totals	2.00	1450.00 \$1,450	40.85 \$41	0.00 \$0	0.00	1490.85 \$1,491
U15 MECHANICAL	2	\$1,450	\$41	\$0	\$0	\$1,491

Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
ESTIMATE TOTAL	217	\$5,801	\$4,875	\$1,219	\$0	\$11,895
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		γo	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$5,801	\$4,875	\$1,219	\$0	\$11,895 \$1,190 \$0 \$1,190
JOB TOTAL						\$14,274

Estimate: 61XX AREA Date: 06-Aug-94
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #: 94013.02

Location: FORT KNOX, KY Job #: 94013.02 Sq. footage: MAIN GAS LINE City indx:Louisville, KY 

SUMMARY

·						
	Manhours	Matl	Labor	Equipment	Sub	Total
			======			
U02 SITEWORK U15 MECHANICAL	215 2	\$4,351 \$1,450	\$4,834 \$41	\$1,219 \$0	\$0 \$0	\$10,404 \$1,491
TOTAL	217	\$5,801	\$4,875	\$1,219	\$0	\$11,895
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	•	
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$5,801	\$4,875	\$1,219	\$0	\$11,895 \$1,190 \$0 \$1,190
JOB TOTAL						\$14,274

Estimate: 611X AREA Date: 06-Aug-94 COST ESTIMATE Description: Project: LIMITED EEAP (GLASSBid Date: FORT KNOX, KY Job #: 94013.02 SUBMAIN GAS LINE City indx:Louisville, KY Location: Sq. footage: Description \_\_\_\_\_ Equipment Manhours TAMPING TRENCH B'FILL, VIBRATING PLATE, ADD 0222541900 44.00 C.Y. 0.09 2.41 Unit values 0.00 1.74 0.67 0.00 \$0 \$76 Totals 3.92 \$29 \$0 \$105 TRENCH EXCVTNG 40HP CHNTRNCHR&BKFL 12"W24"D 0222582800 590.00 L.F. 0.00 0.24 0.24 Unit values 0.01 0.00 0.47 Totals 5.90 \$0 \$139 \$139 \$0 \$278 HORZ BORNG, .5"WALL, 3"DIA CASING, ROCKY SOIL 0222700100 410.00 L.F. 15.58 0.62 0.10 10000.00 10016.30 Unit values 0.03 \$42 11.89 \$6,386 \$253 \$10,000 \$16,681 Totals BEDDING, FOR PIPE IN TRENCH SAND, DEAD OR 0260120200 11.00 C.Y. BANK 3.37 1.37 7.17 Unit values 0.16 2.43 0.00 1.76 \$27 \$37 \$15 \$0 Totals \$79 0260120500 BEDDING, PLACING IN TRENCH 11.00 C.Y. Unit values 0.09 0.00 1.74 0.67 0.00 2.41 Totals 0.98 \$0 \$19 \$7 \$0 \$26 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. Unit values 300.98 1.56 259.60 35.47 5.91 0.00 Totals 1.56 \$6 \$260 \$35 \$0 \$301 0268520200 GAS SERVICE & DISTRIB PIPING, POLYETHYLENE, 60-PSI 2" DIAM COIL SDR 11 1000.00 L.F. Unit values 0.07 0.75 1.48 0.00 2.23 0.00 Totals 67.00 \$753 \$0 \$0 \$1,480 \$2,233 U02 SITEWORK 93 \$7,426 \$2,039 \$238 \$10,000 \$19,703

Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
1562600139		ANCE REGUI	LATORS DO	UBLE DIAPHRA	AGM 1.00	Ea.
Unit values Totals	0.73 0.73	420.00 \$420	16.42 \$16	0.00 \$0	0.00	436.42 \$436
U15 MECHANICAL	1	\$420	\$16	\$0	\$0	\$436

	========			*********		
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
==========	=======					=========
ESTIMATE TOTAL	94	\$7,846	\$2,055	\$238	\$10,000	\$20,139
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	. \$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$7,846	\$2,055	\$238	\$10,000	\$20,139 \$2,014 \$0 \$2,014
JOB TOTAL						\$24,167

Estimate: 611X AREA Date: 06-Aug-94
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBID Date:
Location: FORT KNOX, KY Job #: 94013.02
Sq. footage: SUBMAIN GAS LINE City indx:Louisville, KY

SUMMARY

	S	JMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======:					========
U02 SITEWORK U15 MECHANICAL	93 1	\$7,426 \$420	\$2,039 \$16	\$238 \$0	\$10,000 \$0	\$19,703 \$436
TOTAL	94	\$7,846	\$2,055	\$238	\$10,000	\$20,139
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$ <u>.</u> 0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$7,846	\$2,055	\$238	\$10,000	\$20,139 \$2,014 \$0 \$2,014
JOB TOTAL						\$24,167

14-Oct-94 Date: BLDG 6113 Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: 94013.02 FORT KNOX, KY Job #: Location: City indx:Louisville, KY 6900.00 Sq. footage: Description Line # Equipment Sub Labor Matl Manhours SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 320.00 L.F. 4"DIAMETER 0.00 3.16 1.29 0.00 0.15 Unit values \$411 \$0 \$1,421 48.00 \$0 \$1,010 Totals HVAC DEMO, MECH EOPT HEAVY ITEM 0207183600 0.75 Ton 380.36 0.00 0.00 380.36 14.55 0.00 Unit values \$0 \$0 \$0 \$285 \$285 10.91 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 0.24 0.00 0.00 1.97 2.21 0.07 Unit values \$336 \$40 \$0 \$376 \$0 Totals 12.07 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 50.00 Ea. DIAMETER PIPE 5.55 0.68 0.00 6.23 0.20 0.00 Unit values \$0 \$278 \$34 \$0 \$312 10.00 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 300.98 35.47 5.91 0.00 1.56 259.60 Unit values \$260 \$35 \$6 \$0 \$301 Totals 1.56 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 2.96 0.17 0.00 5.06 1.92 0.11 Unit values \$9 \$0 \$253 5.35 \$96 \$148 Totals \$2,092 \$500 \$0 \$2,948 UO2 SITEWORK 88 \$356

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Line #	Description	1				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
1554510245	HTG INFA-RI	UNT GAS	ELEC IG	•	1.00	
Unit values Totals	8.00 8.00	760.00 \$760	163.40 \$163	0.00 \$0	21687.00 \$21,687	22610.40 \$22,610
1562600137	GAS APPLIANTYPE 1-1/4			UBLE DIAPHR	RAGM 1.00	Ea.
Unit values Totals		226.00 \$226	12.10 \$12	0.00 \$0	0.00	238.10 \$238
U15 MECHANICAL	9	\$986	\$175	\$0	\$21,687	\$22,848

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
==========	=========			========				
ESTIMATE TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796		
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$-0			
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580		
JOB TOTAL						\$30,955		

Estimate: BLDG 6113 Date:
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:

Date: 14-Oct-94

City indx:Louisville, KY

Location: FORT KNOX, KY Job #: 94013.02 Sq. footage: 6900.00 City indx:Louisville SUMMARY

	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======		========			
U02 SITEWORK U15 MECHANICAL	88 9	\$356 \$986	\$2,092 \$175	\$500 \$0	\$0 \$21,687	\$2,948 \$22,848
TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE COCONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580
JOB TOTAL			*			\$30,955

A09 ELECTRICAL

53

\_\_\_\_\_\_\_ Estimate: BLDG 6113 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: 94013.02 FORT KNOX, KY Job #: Location: City indx:Louisville, KY Sq. footage: Description Line # Equipment Manhours Matl Labor Sub \_\_\_\_\_ 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 230.00 L.F. Unit values 0.15 2.22 4.57 0.00 0.00 6.79 34.27 \$510 \$1,052 \$0 \$0 Totals \$1,562 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 120.00 L.F. INCL CONDUIT, WIRE, AND RECEPTACLES 0.00 Unit values 2.22 6.79 0.15 4.57 0.00 Totals 17.88 \$266 \$549 \$0 \$0 \$815 \$0

\$776 \$1,601

\$0

\$2,377

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Line #	Description		
	Manhours Matl	Labor . Equipment	Sub Total
	=======================================		
1517010650	1	T PIPE, SCHEDULE 40,	000 00 7 7
Unit values Totals	0.44 4.17 97.68 \$917	10.30 0.00 \$2,267 \$0	0.00 14.47 \$0 \$3,184
1517011310		TEEL GALV SCH 40 THR	
Unit values Totals	0.13 1.64 43.18 \$558	" DIAM 2.88 0.00 \$978 \$0	0.00 4.52 \$0 \$1,536
1519010320	ALUMINUM REFLECTOR	s W/HANGERS	29.00 Ea.
Unit values Totals	0.50 39.79 14.50 \$1,154	3.80 0.00 \$110 \$0	0.00 43.59
1524105040	VACUUM PUMP AND VE	NT PIPING	1 00 To
Unit values Totals	3.00 738.35 3.00 \$738	120.15 0.00 \$120 \$0	1.00 Ea. 0.00 858.50 \$0 \$858
1552301020	CRV-90 GAS FIRED B	URNER, 90 MBH & COM	BUSTION CHAMBER
Unit values Totals	1.00 860.00 6.00 \$5,160	URNER, 90 MBH & COM 44.06 0.00 \$264 \$0	6.00 Ea. 0.00 904.06 \$0 \$5,424
1554510160	CO-RAY-VAC VANTAGE	2 INFA-RD HTG UNT,	
Unit values Totals	6.00 1065.00 6.00 \$1,065	163.40 0.00 \$163 \$0	1.00 Ea. 0.00 1228.40 \$0 \$1,228
1554510220	CO-RAY-VAC VANTAGE	2 INFA-RD HTG UNIT,	
Unit values Totals	4.00 935.00 16.00 \$3,740	81.70 0.00 \$327 \$0	4.00 Ea. 0.00 1016.70 \$0 \$4,067
1556800120	CO-RAY-VAC VANTAGE	2 VENT PIPE	
Unit values Totals	1.60 70.00 8.00 \$350	76.50 0.00 \$382 \$0	5.00 Ea. 0.00 146.50 \$0 \$732
1574205220	ELECTRIC THERMOSTA	T W/ COVER AND WIRING	
Unit values Totals	1.00 75.00 6.00 \$450	27.55 0.00 \$165 \$0	6.00 Ea. 0.00 102.55 \$0 \$615

Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================								
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908		
1631200100	HEATING	SYSTEM POWE	R / CONTR	OL PANEL				
100110			·		1.00	Ea.		
Unit values	2.96	330.76	70.58	0.00	0.00	401.34		
Totals	2.96	\$331	\$71	\$0	\$0	\$402		
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402		

		========				
Line #	Descripti	.on				
	Manhours	Matl	Labor	Equipment	Sub	Total
			-		•	
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP	0.00% 0.00%	\$0 \$0		•		
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

Description:

Estimate: BLDG 6113 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Project:

LIMITED EEAP (GLASSBid Date:

Location: Sq. footage:

FORT KNOX, KY

Job #: 94013.02 City indx:Louisville, KY

54. 2000.50			=======			
	S	SUMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======	========	=======	========	========	
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 201 3	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402
TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0		•	
EQUIPT MARKUP SUB MARKUP	0.00%		4.0	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

BLDG 6114 Date: 14-Oct-94 Estimate: COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: Job #: 94013.02 Location: FORT KNOX, KY City indx:Louisville, KY Sq. footage: 6900.00 Description \_\_\_\_\_ Equipment Matl Labor Manhours \_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 320.00 L.F. 4"DIAMETER 0.00 Unit values 3.16 0.15 1.29 0.00 4.44 48.00 Totals \$0 \$1,010 \$411 \$0 \$1,421 0207180380 HVAC DEMO, BOILER GAS/OIL STL >150MBH 1.00 Ea. 0.00 Unit values 12.00 0.00 323.82 0.00 323.82 Totals \$0 \$0 12.00 \$324 \$0 \$324 0207183600 HVAC DEMO, MECH EQPT HEAVY ITEM 0.75 Ton 0.00 Unit values 14.55 0.00 380.36 0.00 380.36 Totals 10.91 \$0 \$285 \$0 \$0 \$285 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 0.00 1.97 0.24 0.07 Unit values 0.00 2.21 \$0 \$336 \$40 12.07 Totals \$0 \$376 0208401000 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" DIAMETER PIPE 50.00 Ea. Unit values 0.00 5.55 0.20 0.68 0.00 6.23 Totals \$278 10.00 \$0 \$34 \$0 \$312 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. Unit values 1.56 259.60 35.47 5.91 300.98 0.00 1.56 Totals \$260 \$6 \$35 \$0 \$301 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 0.11 1.92 Unit values 2.96 0.17 0.00 5.06 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 100 \$356 \$2,416 \$500 \$0 \$3,272

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Line #	Descriptio					
	Manhours	Matl	Labor I	Equipment	Sub	Total
=======================================			=======	=======		
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	(See At	tached for	Breakdown
Unit values Totals	8.00	760.00 \$760	163.40 \$163			22610.40 \$22,610
1562600137	GAS APPLIA TYPE 1-1/4			BLE DIAPHR	AGM 1.00	Ea.
Unit values Totals		226.00 \$226	12.10 \$12	0.00 \$0	0.00	238.10 \$238
U15 MECHANICAL	9	\$986	\$175	\$0	\$21,687	\$22,848

	Line #	Description							
		Manhours	Matl	Labor	Equipment	Sub	Total		
	ESTIMATE TOTAL	109	\$1,342	\$2,591	\$500	\$21,687	\$26,120		
	SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	**	·		
	SUB MARKUP  TOTAL BEFORE CONTINGENCY BOND PROFIT	0.00% ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,591	\$500	\$0 \$21,687	\$26,120 \$2,612 \$0 \$2,612		
	JOB TOTAL						\$31,344		

Estimate: BLDG 6114 Date:
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #:

14-Oct-94

94013.02

Sq. footage: 6900.00

City indx:Louisville, KY

	========				, =======		
	S	UMMARY					
	Manhours	Matl	Labor	Equipment	Sub	Total	
U02 SITEWORK U15 MECHANICAL	100 9	\$356 \$986	\$2,416 \$175	\$500 \$0	\$0 \$21,687	\$3,272 \$22,848	
TOTAL	109	\$1,342	\$2,591	\$500	\$21,687	\$26,120	
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0			
SUB MARKUP	0.00%		•		\$0		
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,591	\$500	\$21,687	\$26,120 \$2,612 \$0 \$2,612	
JOB TOTAL			•			\$31,344	

14-Oct-94 BLDG 6114 Date: INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: 94013.02 Job #: FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description Line # Sub . Labor . Equipment Matl Manhours 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 230.00 L.F. AND RECEPTACLES 6.79 0.00 0.15 2.22 4.57 0.00 Unit values \$0 \$0 \$1,562 Totals 34.27 \$510 \$1,052 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES
0.15 2.22 4.57 0.00 120.00 L.F. 0.00 6.79 0.00 Unit values \$0 \$0 \$549 \$815 17.88 \$266 Totals \$0 \$0 \$2,377 \$1,601 \$776 A09 ELECTRICAL 53

=======================================	=========	========	======	=======================================		
Line #	Description	on				
	Manhours		Labor	Equipment	Sub	Total
=======================================	=========	: = = = = = = = = = = = = = = = = = = =				
1517010650	BLACK STEE	L RADIANT	PIPE, S	CHEDULE 40,	THREADED, 220.00	L.F.
Unit values Totals	0.44 97.68		10.30 \$2,267	0.00 \$0		14.47 \$3,184
1517011310	GAS SERVIC	E PIPE ST	EEL GALV DIAM	SCH 40 THR	340.00	L.F.
Unit values Totals	0.13 43.18	1.64	2.88	0.00 \$0		4.52 \$1,536
1519010320	ALUMINUM F	REFLECTORS	W/HANGE	RS	29.00	Ea.
Unit values Totals	0.50 14.50	39.79 \$1,154			0.00	43.59 \$1,264
1524105040	VACUUM PUN	IP AND VEN	T PIPING		1.00	Ea
Unit values Totals	3.00 3.00	738.35 \$738	120.15 \$120		0.00	858.50 \$858
1552301020	CRV-90 GAS	FIRED BU	RNER, 90	MBH & COM	BUSTION CH	IAMBER Ea
Unit values Totals	1.00	860.00 \$5,160	44.06 \$264		0.00	904.06 \$5,424
1554510160	CO-RAY-VA	VANTAGE	2 INFA-	RD HTG UNT,	GAS 100ME 1.00	BH Ea.
Unit values Totals	6.00 6.00	1065.00 \$1,065	163.40 \$163		0.00	
1554510220	CO-RAY-VAC	VANTAGE	2 INFA-R	D HTG UNIT,	GAS 40 ME 4.00	BH Ea.
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327			1016.70 \$4,067
1556800120	CO-RAY-VAC	VANTAGE	2 VENT P	IPE	5.00	Fa
Unit values Totals	1.60 8.00	70.00 \$350	76.50 \$382		0.00	146.50 \$732
1574205220	ELECTRIC T	THERMOSTAT	W/ COVE	R AND WIRIN	G 6.00	Ea.
Unit values Totals	1.00 6.00	75.00 \$450	27.55 \$165			102.55 \$615

Line #	Descript	ion				
	Manhours	Matl	Labor	Equipment	Sub	Total
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908
1631200100	HEATING	SYSTEM POWER	/ CONT	ROL PANEL	1.00	<b>P</b> -2
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	. \$71	\$0	\$0	\$402

Line #	Descripti	.on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		γ°	\$0	\$0	•
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

Estimate: BLDG 6114

Date: 14-Oct-94

Description: INFRARED HEATING SYSTEM COST ESTIMATE

Project:

LIMITED EEAP (GLASSBid Date:

FORT KNOX, KY Location:

Job #: 94013.02 City indx:Louisville.

Sq.	footage:	City inax:Louisville, KY					
===	SUMMARY						
		Manhours	Matl	Labor	Equipment	Sub	Total
===	=========	========	=======				,
A09 U15 U16	•	53 201 3	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402
TOT	AL	257	\$15,239	\$6,448	. \$0	\$0	\$21,687
	ES TAX L MARKUP	0.00% 0.00%	\$0 \$0				
EQU	OR MARKUP IPT MARKUP MARKUP	0.00% 0.00% 0.00%	·	\$0	\$0	\$0	
	TINGENCY D	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0 \$0
JOB	TOTAL						\$21,687

Date: 14-Oct-94 BLDG 6115 COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY 6900.00 Sq. footage: Description Line # Equipment Manhours Matl Labor SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 4"DIAMETER 320.00 L.F. 0.00 3.16 1.29 0.00 0.15 Unit values \$0 \$1,010 \$411 \$0 \$1,421 48.00 Totals 0207183600 HVAC DEMO, MECH EQPT HEAVY ITEM 0.75 Ton 0.00 14.55 0.00 380.36 0.00 380.36 Unit values \$0 \$0 10.91 \$0 \$285 \$285 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 0.24 2.21 0.07 0.00 1.97 0.00 Unit values \$336 \$40 \$0 \$376 12.07 \$0 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 50.00 Ea. DIAMETER PIPE 5.55 0.68 0.00 6.23 0.20 0.00 Unit values \$278 \$34 \$0 \$312 \$0 Totals 10.00 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 0.00 5.91 300.98 35,47 Unit values 1.56 259.60 \$0 \$6 \$301 \$260 \$35 Totals 1.56 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 50.00 L.F. END, TAR COAT&WRAP 1"DIAM 0.11 0.17 0.00 5.06 1.92 2.96 Unit values 5.35 \$96 \$148 \$9 \$0 \$253 Totals \$0 \$2,948 \$2,092 \$500 U02 SITEWORK 88 \$356

					========		
Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	=======================================						
1554510245	HTG INFA-R	D UNT GAS	ELEC IG	N (See Att	ached for	Breakdown)	
Unit values Totals	8.00 8.00	760.00 \$760	163.40 \$163	0.00 \$0	21687.00 \$21,687	22610.40	
1562600137	GAS APPLIANCE REGULATORS DOUBLE DIAPHRAGM TYPE 1-1/4" PIPE SIZE 1.00 Ea.						
Unit values Totals		226.00 \$226	12.10 \$12	0.00 \$0	0.00	238.10 \$238	
U15 MECHANICAL	9	\$986	\$175	. \$0	\$21,687	\$22,848	

	========						
Line #	Description						
	Manhours	Matl	Labor E	Equipment	Sub	Total	
	=========						
ESTIMATE TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796	
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0		
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580	
TOR TOTAL						\$30,955	

\$30,955

Estimate: BLDG 6115
Description: COST ESTIMATE

Date: 14-Oct-94

Project:

LIMITED EEAP (GLASSBID Date:

FORT KNOX, KY Job #: 94013.02

Location:

a a data a

JOB TOTAL

Sq. footage:	6900.00		City indx	:Louisville	, KY ========	
SUMMARY						
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	=======	:======:			
U02 SITEWORK U15 MECHANICAL	. 88 . 9	\$356 \$986	\$2,092 \$175	\$500 \$0	\$0 \$21,687	\$2,948 \$22,848
TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	. \$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	CONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580

\_\_\_\_\_\_ Estimate: BLDG 6115 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: 94013.02 FORT KNOX, KY Job #: · Location: City indx:Louisville, KY Sq. footage: . Description \_\_\_\_\_\_ Labor Equipment Sub Manhours Matl 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 230.00 L.F. 4.57 0.00 6.79 Unit values 0.15 2.22 0.00 34.27 \$0 \$0 \$1,562 Totals \$510 \$1,052 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. 6.79 2.22 4.57 0.00 0.00 Unit values 0.15 \$0 \$0 Totals 17.88 \$266 \$549 \$815 \$0 \$0 \$776 \$1,601 \$2,377 A09 ELECTRICAL 53

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
==============	=======================================					
1517010650	W/CDIGS			CHEDULE 40	220.00	L.F.
Unit values Totals	0.44 97.68	4.17 \$917	10.30 \$2,267	0.00	0.00 \$0	14.47 \$3,184
1517011310	GAS SERVIO	E PIPE ST	EEL GALV DIAM	SCH 40 THE	RD W/CPLG 340.00	& HNGR SZD L.F.
Unit values Totals	0.13 43.18	1.64 \$558	2.88 \$978	0.00	0.00 \$0	4.52 \$1,536
1519010320	ALUMINUM F	REFLECTORS	W/HANGE	CRS	29.00	Ea.
Unit values Totals	0.50 14.50	39.79 \$1,154	3.80 \$110	0.00	0.00	43.59
1524105040	VACUUM PUN	IP AND VEN	T PIPING	·	1.00	Fa
Unit values Totals	3.00 3.00	738.35 \$738	120.15 \$120	0.00	0.00	
1552301020	CRV-90 GAS	FIRED BU	RNER, 90		<i>c nn</i>	HAMBER Ea.
Unit values Totals	1.00 6.00	860.00 \$5,160	44.06 \$264	0.00	0.00	904.06 \$5,424
1554510160	CO-RAY-VAC	VANTAGE	2 INFA-	RD HTG UNT	GAS 100M	BH Ea.
Unit values Totals	6.00 6.00	1065.00 \$1,065	163.40 \$163	0.00	0.00	1228.40 \$1,228
1554510220	CO-RAY-VAC	VANTAGE	2 INFA-F		4 00	
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327	0.00		1016.70 \$4,067
1556800120	CO-RAY-VAC	C VANTAGE	2 VENT P	PIPE	5.00	Fa
Unit values Totals	1.60 8.00	70.00 \$350	76.50 \$382		0.00	146.50
1574205220	ELECTRIC T	THERMOSTAT	W/ COVE	R AND WIRI	NG 6.00	Ea.
Unit values Totals	1.00 6.00	75.00 \$450	27.55 \$165			102.55

Line #	Descript:	ion				
	Manhours	Matl	Labor	Equipment	Sub .	Total
=======================================	=======					
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908
1631200100	HEATING S	SYSTEM POWER	R / CONTI	ROL. PANEL	1.00	Ea.
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================	=======	=======================================	======	========				
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687		
SALES TAX MATL MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0					
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00%		Şυ	\$0	\$0			
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0		
TOR TOTAL						\$21,687		

Estimate: BLDG 6115 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBID Date:
Location: FORT KNOX, KY Job #: 94013.02

Location:

Job #: 94013.02 City indx:Louisville, KY

Sq. footage:	City indx:bouisville, ki					
*==========	======== S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
==========	=======		======			
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	201	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402
TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

Date: 14-Oct-94 BLDG 6116 Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: City indx:Louisville, KY 6900.00 Sq. footage: Description Line # Labor Equipment Matl Manhours \_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 320.00 L.F. 4"DIAMETER 0.00 0.00 4.44 0.15 3.16 1.29 Unit values \$0 48.00 \$0 \$1,010 \$411 \$1,421 Totals HVAC DEMO, MECH EOPT HEAVY ITEM 0207183600 0.75 Ton 0.00 380.36 380.36 0.00 0.00 14.55 Unit values 10.91 \$0 \$285 \$0 \$0 \$285 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 0.07 0.24 0.00 0.00 1.97 2.21 Unit values \$336 \$40 \$0 \$376 12.07 \$0 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 50.00 Ea. 5.55 0.68 0.00 6.23 0.20 0.00 Unit values \$0 \$278 \$34 \$0 \$312 10.00 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. Unit values 35.47 5.91 0.00 300.98 1.56 259.60 1.56 \$260 \$35 \$6 \$0 \$301 Totals GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 50.00 L.F. END, TAR COAT&WRAP 1"DIAM 5.06 1.92 0.17 0.00 Unit values 0.11 2.96 \$96 \$9 \$0 \$253 5.35 \$148 Totals U02 SITEWORK \$0 \$2,948 88 \$356 \$2,092 \$500

Line #	Description	n				
	Manhours	Matl	Labor E	quipment	Sub	Total
1554510245	HTG INFA-RI	O UNT GAS	ELEC IGN	(See At	tached fo	or Breakdow
Unit values Totals	8.00 8.00	760.00 \$760	163.40 \$163	0.00 \$0	21687.00	22610.40 \$22,610
1562600137	GAS APPLIA			LE DIAPHRA		_
Unit values Totals	TYPE 1-1/4' 0.53 0.53		12.10 \$12	0.00	1.00 0.00 \$0	238.10 \$238
U15 MECHANICAL	9	\$986	\$175	\$0	\$21,687	\$22,848

=====			=======					
Line :	<b>‡</b>	Description						
		Manhours	Matl	Labor	Equipment	Sub	Total	
====:	: = = = = = = =		======					
ESTIM	ATE TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796	
	TAX MARKUP MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0				
EQUIP'SUB MA	r markup Arkup	0.00% 0.00%			\$0	\$0		
	IGENCY	CONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580	
JOB TO	OTAL					•	\$30,955	

Estimate:

Date: 14-Oct-94

Description: Project:

BLDG 6116 COST ESTIMATE

LIMITED EEAP (GLASSBid Date:

Location:
Sq. footage:

FORT KNOX, KY

Job #: 94013.02 City indx:Louisville, KY

Sq. footage:	6900.00		ercy indx		, <u> </u>			
=======================================	SUMMARY							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================		======						
U02 SITEWORK U15 MECHANICAL	88 9	\$356 \$986	\$2,092 \$175	\$500 \$0	\$0 \$21,687	\$2,948 \$22,848		
TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796		
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0			
	0.00% ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580		
JOB TOTAL						\$30,955		

\_\_\_\_\_\_\_ Estimate: BLDG 6116 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: City indx:Louisville, KY Sg. footage: Description \_\_\_\_\_\_ Labor Equipment Manhours Matl - -115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 230.00 L.F. 0.00 6.79 4.57 0.15 2.22 0.00 Unit values \$0 \$1,562 Totals 34.27 \$510 \$1,052 \$0 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. 6.79 2.22 4.57 0.00 0.00 0.15 Unit values \$266 \$549 \$0 \$0 \$815 Totals 17.88 A09 ELECTRICAL 53 \$776 \$1,601 \$0 \$0 \$2,377

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Line #	Description						
	Manhours N	Matl	Labor	Equipme	ent S	ub	Total
=======================================							
1517010650	BLACK STEEL W/CPLGS				2	20.00	L.F.
Unit values Totals	0.44 97.68	4.17 \$917	10.30 \$2,267	0	.00 \$0	0.00	14.47 \$3,184
1517011310	GAS SERVICE FOR CVRG 10'	PIPE STE	EEL GALV	SCH 40	THRD W/	CPLG & 40.00	
Unit values Totals	FOR CVRG 10' 0.13 43.18	1.64 \$558	2.88 \$978	0	.00 \$0	0.00 \$0	4.52 \$1,536
1519010320	ALUMINUM REP	FLECTORS	W/HANGE	CRS ·		29.00	Ea.
Unit values Totals		39.79 31,154				0.00	43.59 \$1,264
1524105040	VACUUM PUMP	AND VENT	r PIPING	;		1.00	Ea.
Unit values Totals	3.00 3.00			0	.00 \$0	0.00	858.50 \$858
1552301020	CRV-90 GAS I	FIRED BUR	RNER, 90	MBH &	COMBUST	ION CH	
Unit values Totals		360.00 35,160	44.06 \$264		.00 \$0	0.00	904.06 \$5,424
1554510160	CO-RAY-VAC V	/ANTAGE 2	2 INFA-	RD HTG	UNT, GAS	1.00MB	H Ea
Unit values Totals	6.00 10 6.00 \$	065.00 \$1,065			.00 \$0		1228.40
1554510220	CO-RAY-VAC V	VANTAGE 2	2 INFA-R	D HTG UI	NIT, GAS	40 MB	
Unit values Totals		935.00 83,740	81.70 \$327		.00 \$0	0.00	
1556800120	CO-RAY-VAC V	/ANTAGE 2	VENT P	PIPE.		5.00	Ea
Unit values Totals	1.60 8.00	70.00 \$350	76.50 \$382		.00 \$0	0.00	146.50 \$732
1574205220	ELECTRIC THE	ERMOSTAT	W/ COVE	R AND W	IRING	6.00	Ea.
Unit values Totals	1.00 6.00	75.00 \$450	27.55 \$165		.00 \$0	0.00	102.55 \$615

Line #	Descript	ion				
	Manhours	Matl	Labor	Equipment	Sub	Total
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908
1631200100	HEATING	SYSTEM POWE	R / CONT	ROL PANEL	1.00	Ea.
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00 \$0	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

		========				
Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========					
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0 ·	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	CONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	<b>\$0</b>	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

Description:

Estimate: BLDG 6116 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Project:

LIMITED EEAP (GLASSBid Date:

Location: Sq. footage:

FORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY

Sq. Iootage:	city max:boursville, ki						
	S	UMMARY					
	Manhours	Matl	Labor	Equipment	Sub	Total	
	=======	=======			=======		
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	201	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402	
TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687	
SALES TAX MATL MARKUP LABOR MARKUP EOUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0			
SUB MARKUP	0.00%			40	\$0		
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0	
JOB TOTAL						\$21,687	

BLDG 6117 Date: 14-Oct-94 Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: 6900.00 City indx:Louisville, KY Sq. footage: Description ' \_\_\_\_\_ Equipment Manhours Matl Labor \_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 320.00 L.F. 4"DIAMETER 0.00 3.16 1.29 Unit values 0.15 0.00 4.44 Totals \$1,010 48.00 \$0 \$411 \$0 \$1,421 0207180380 HVAC DEMO, BOILER GAS/OIL STL >150MBH 1.00 Ea. 0.00 Unit values 12.00 0.00 323.82 0.00 323.82 \$0 Totals 12.00 \$0 \$324 \$0 \$324 HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.75 Ton 0.00 0.00 380.36 0.00 380.36 14.55 Unit values \$0 \$0 \$285 \$0 10.91 \$285 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 1.97 0.24 0.00 2.21 Unit values 0.07 0.00 12.07 \$0 \$336 \$40 \$0 \$376 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 50.00 Ea. 0.68 0.00 5.55 0.00 Unit values 0.20 6.23 Totals 10.00 \$0 \$278 \$34 \$0 \$312 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. Unit values 1.56 259.60 35.47 5.91 0.00 300.98 Totals 1.56 \$260 \$35 \$6 \$0 \$301 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 0.17 Unit values 0.11 1.92 2.96 0.00 5.06 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK \$500 100 \$356 \$2,416 \$0 \$3,272

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Line #	Description	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========					
1554510245	HTG INFA-R	D UNT GAS	ELEC IG	N (See At	tached for	r Breakdown LS
Unit values Totals	8.00 8.00	760.00 \$760	163.40 \$163	· 0.00 \$0	21687.00 \$21,687	22610.40 \$22,610
1562600137	GAS APPLIANTYPE 1-1/4			UBLE DIAPHE	RAGM 1.00	Fa
Unit values Totals	0.53 0.53		12.10	0.00 \$0	0.00	238.10 \$238
U15 MECHANICAL	9	\$986	\$175	\$0	\$21,687	\$22,848

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	:========					
ESTIMATE TOTAL	109	\$1,342	\$2,591	\$500	\$21,687	\$26,120
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,591	\$500	\$21,687	\$26,120 \$2,612 \$0 \$2,612
JOB TOTAL						\$31,344

Estimate: BLDG 6117

Date: 14-Oct-94

Description: COST ESTIMATE

Project:

LIMITED EEAP(GLASSBid Date:

Location: Sq. footage: 6900.00

FORT KNOX, KY Job #: 94013.02 6900.00 City indx:Louisville, KY

CIIMMARY

SUMMARY							
		Manhours	Matl	Labor	Equipment	Sub	Total
		=======	========	=======			=======
	U02 SITEWORK U15 MECHANICAL	100	\$356 \$986	\$2,416 \$175	\$500 \$0	\$0 \$21,687	\$3,272 \$22,848
	TOTAL	109	\$1,342	\$2,591	\$500	\$21,687	\$26,120
	SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
)	TOTAL BEFORE C CONTINGENCY BOND PROFIT	CONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,591	\$500	\$21,687	\$26,120 \$2,612 \$0 \$2,612
	JOB TOTAL						\$31,344

Date: 14-Oct-94 BLDG 6117 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: 94013.02 Job #: FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description Labor Equipment Sub Manhours Matl 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 230.00 L.F. AND RECEPTACLES 6.79 0.00 0.00 Unit values 0.15 2.22 4.57 \$0 \$0 \$1,562 \$1,052 Totals 34.27 \$510 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES
0.15 2.22 4.57 0.00 120.00 L.F. 6.79 0.00 Unit values \$549 \$0 \$0 \$815 \$266 Totals 17.88 \$0 \$0 \$2.377 A09 ELECTRICAL 53 \$776 \$1,601

Line #	Description	on				
	Manhours			Equipment		Total
=======================================						
1517010650	BLACK STER W/CPLGS	EL RADIANT	PIPE, S	CHEDULE 40,	THREADED 220.00	L.F.
Unit values Totals	0.44 97.68	4.17 \$917	10.30 \$2,267	0.00	0.00 \$0	14.47 \$3,184
1517011310	FOR CURG 1	10'0C 1/2"	MATO		340.00	& HNGR SZD L.F.
Unit values Totals	0.13 43.18	1 64	2.88	0.00	0.00 \$0	4.52 \$1,536
1519010320	ALUMINUM H	REFLECTORS	W/HANGE		29.00	Ea.
Unit values Totals	0.50 14.50	39.79 \$1,154	3.80 \$110	0.00	0.00	
1524105040	VACUUM PUN	MP AND VEN			1.00	Ea.
Unit values Totals	3.00	738.35 \$738	120.15 \$120	0.00	0.00	
1552301020					6.00	HAMBER Ea.
Unit values Totals	1.00 6.00	860.00 \$5,160	44.06 \$264	0.00	0.00	904.06 \$5,424
1554510160	CO-RAY-VA	C VANTAGE	2 INFA-	RD HTG UNT,	GAS 100M 1.00	BH Ea.
Unit values Totals		1065.00 \$1,065	163.40 \$163	0.00 \$0	0.00	
1554510220	CO-RAY-VA	C VANTAGE	2 INFA-R	D HTG UNIT,	GAS 40 M 4.00	
Unit values Totals			81.70 \$327			1016.70
1556800120	CO-RAY-VA	C VANTAGE	2 VENT P	IPE	5.00	Fa
Unit values Totals		70.00 \$350			0.00	146.50
1574205220	ELECTRIC 7	THERMOSTAT	W/ COVE	R AND WIRING	6.00	Ea.
Unit values Totals	1.00	75.00 \$450	27.55 \$165		0.00	102.55

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Line #	Descript	ion				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	======		=======	========		
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908
1631200100	HEATING	SYSTEM POWE	R / CONTI	ROL PANEL	1.00	Ea.
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

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Line #	Description								
	Manhours	Matl	Labor	Equipment	Sub	Total			
=======================================	=======								
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687			
SALĖS TAX MATL MARKUP	0.00%	\$0 \$0			•				
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	<b>\$</b> 0	\$0				
TOTAL BEFORE C CONTINGENCY BOND PROFIT	CONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0			
TOR TOTAL						\$21,687			

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Estimate: BLDG 6117 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #: 94013.02
City indx:Louisville, KY

Sq. footage:	City indx:Louisville, Ki					
	S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================				<u> </u>		
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	201	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402
TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
•	O.00% ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

Date: 14-Oct-94 BLDG 6118 COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: 94013.02 Job #: FORT KNOX, KY Location: City indx:Louisville, KY 6900.00 Sq. footage: Description Line # Labor Equipment Matl Manhours SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 320.00 L.F. 4"DIAMETER 0.00 1.29 0.00 4.44 0.15 3.16 Unit values \$411 \$0 48.00 \$0 \$1,010 \$1,421 Totals HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.75 Ton 0.00 0.00 380.36 0.00 380.36 Unit values 14.55 \$285 \$0 \$0 \$285 10.91 \$0 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 1.97 0.24 0.00 2.21 0.07 0.00 Unit values \$336 \$40 \$0 \$376 12.07 \$0 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 50.00 Ea. DIAMETER PIPE 6.23 5.55 0.68 0.00 0.00 0.20 Unit values \$0 \$278 \$34 \$0 \$312 10.00 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 5.91 0.00 300.98 35.47 259.60 Unit values 1.56 \$6 \$0 \$301 Totals 1.56 \$260 \$35 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 0.11 1.92 2.96 0.17 0.00 5.06 Unit values 5.35 \$96 \$148 \$9 \$0 \$253 Totals \$2,948 \$0 U02 SITEWORK 88 \$356 \$2,092 \$500

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Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
			=======				
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	N (See At	tached for	r Breakdown	
Unit values Totals	8.00	760.00 \$760	163.40 \$163		21687.00 \$21,687	22610.40	
1562600137	GAS APPLIA			JBLE DIAPHR			
Unit values Totals	TYPE 1-1/4 0.53 0.53		ZE 12.10 \$12	0.00 \$0	1.00 0.00 \$0	Ea. 238.10 \$238	
U15 MECHANICAL	9	\$986	\$175	\$0	\$21.687	\$22.848	

Line #	Description								
	Manhours	Matl	Labor	Equipment	Sub	Total			
ESTIMATE TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796			
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0				
	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580			
JOB TOTAL						\$30.955			

Estimate: BLDG 6118

Date: 14-Oct-94

Description: Project:

COST ESTIMATE

LIMITED EEAP (GLASSBid Date:

FORT KNOX, KY

Job #:

94013.02

Location: Sq. footage: 6900.00

City indx:Louisville, KY

CIMMARY

	SUMMARY			•		
	Manhours	Matl	Labor	Equipment	Sub	Total
===========	=======	=======	======	========		
U02 SITEWORK U15 MECHANICAL	88	\$356 \$986	\$2,092 \$175	\$500 \$0	\$0 \$21,687	\$2,948 \$22,848
TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580
JOB TOTAL				•		\$30,955

\_\_\_\_\_\_ Estimate: BLDG 6118 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY Job #: Location: City indx:Louisville, KY Sq. footage: Description Manhours Matl Labor Equipment Sub Total 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 230.00 L.F. 6.79 Unit values 0.15 2.22 4.57 0.00 0.00 \$510 Totals 34.27 \$1,052 \$0 \$0 \$1,562 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES
0.15 2.22 4.57 0.00 120.00 L.F. 6.79 Unit values 0.00 \$0 Totals \$549 \$0 17.88 \$266 \$815 A09 ELECTRICAL 53 \$776 \$1,601 \$0 \$0 \$2,377

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	=======			=======	
1517010650						L.F.
Unit values Totals	0.44 97.68	4.17 \$917	10.30 \$2,267	. 0.00	0.00 \$0	14.47 \$3,184
1517011310	GAS SERVIO	CE PIPE ST	EEL GALV	SCH 40 THR	D W/CPLG 340.00	& HNGR SZD L.F.
Unit values Totals	0.13 43.18	1.64 \$558	2.88 \$978	0.00	0.00 \$0	4.52 \$1,536
1519010320 Unit values	ALUMINUM E	REFLECTORS	W/HANGE	RS	29 00	Fa
Unit values Totals	0.50 14.50	39.79 \$1,154	3.80 \$110	0.00 \$0	0.00	43.59 \$1,264
1524105040	VACUUM PUN	MP AND VEN	T PIPING		1.00	Re
Unit values Totals	3.00	738.35 \$738	120.15 \$120	0.00 \$0	0.00 \$0	858.50 \$858
1552301020						
Unit values Totals	1.00	860.00 \$5,160	44.06 \$264	0.00	0.00 \$0	904.06 \$5,424
1554510160	CO-RAY-VA	C VANTAGE	2 INFA-	RD HTG UNT,	GAS 100M 1.00	
Unit values Totals	6.00 6.00	1065.00 \$1,065	163.40 \$163	· 0.00 \$0	0.00	1228.40
1554510220	CO-RAY-VAC	C VANTAGE	2 INFA-R	D HTG UNIT,	GAS 40 M 4.00	
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327	0.00 \$0	0.00 \$0	1016.70
1556800120	CO-RAY-VAC	VANTAGE	2 VENT P	IPE	F 00	
Unit values Totals	1.60 8.00	70.00 \$350	76.50 \$382		5.00 0.00 \$0	146.50
1574205220	ELECTRIC T	THERMOSTAT	W/ COVE	R AND WIRIN		Fo
Unit values Totals	1.00	75.00 \$450	27.55 \$165		6.00 0.00 \$0	102.55

Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================	======							
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908		
1631200100	HEATING	SYSTEM POWE	R / CONT	ROL PANEL	1.00	Ea		
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402		
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402		

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
			= <b>= = = = = = =</b> :					
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687		
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0					
EQUIPT MARKUP SUB MARKUP	0.00%		ŞU	\$0	\$0			
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0		
JOB TOTAL						\$21,687		

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Estimate: BLDG 6118

BLDG 6118 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Description: Project:

LIMITED EEAP (GLASSBID Date: FORT KNOX, KY Job #:

Location: Sq. footage: Job #: 94013.02 City indx:Louisville, KY

SUMMARY							
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	=======	=======			========		
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 201 3	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$50 \$	\$0 \$0 \$0	\$2,377 \$18,908 \$402	
TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687	
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$ <b>.</b>		•	·	
EQUIPT MARKUP SUB MARKUP	0.00%		4.5	\$0	\$0		
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	. \$0	\$0	\$21,687 \$0 \$0 \$0	
JOB TOTAL	,					\$21,687	

06-Aug-94 614X AREA Date: Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: SUBMAIN GAS LINE City indx:Louisville, KY Sq. footage: Description Line # Equipment Sub Labor Manhours Matl TAMPING TRENCH B'FILL, VIBRATING PLATE, ADD 0222541900 86.00 C.Y. 2.41 0.67 0.00 0.00 1.74 0.09 Unit values \$57 \$0 \$206 \$0 \$149 7.65 Totals TRENCH EXCVTNG 40HP CHNTRNCHR&BKFL 12"W24"D 0222582800 1160.00 L.F. 0.24 0.47 0.24 0.00 0.00 Unit values 0.01 \$274 \$0 \$548 \$0 \$274 11.60 Totals HORZ BORNG , .5 "WALL, 3 "DIA CASING, ROCKY SOIL 0222700100 300.00 L.F. 0.10 0.62 10000.00 10016.30 15.58 0.03 Unit values \$31 \$185 \$10,000 8.70 \$4,673 Totals BEDDING, FOR PIPE IN TRENCH SAND, DEAD OR 0260120200 21.50 C.Y. BANK 7.17 1.37 3.37 0.00 0.16 2.43 Unit values \$72 \$29 \$0 \$153 Totals 3.44 \$52 BEDDING, PLACING IN TRENCH 0260120500 21.50 C.Y. 0.67 0.00 2.41 0.09 0.00 1.74 Unit values \$37 \$14 \$0 \$51 1.91 \$0 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 300.98 35.47 5.91 0.00 259.60 Unit values 1.56 \$6 \$0 \$301 \$260 \$35 Totals 1.56 GAS SERVICE & DISTRIB PIPING, POLYETHYLENE, 60-0268520200 PSI 2" DIAM COIL SDR 11 1460.00 L.F. 2.23 0.00 0.00 0.07 0.75 1.48 Unit values \$3,260 \$0 \$0 97.82 \$1,099 \$2,161 Totals \$6,084 \$2,913 \$411 \$10,000 \$19,408 U02 SITEWORK 133

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========					
1562600139	GAS APPLIA		ATORS DO	OUBLE DIAPHRA	.GM 1.00	Ea.
Unit values Totals	0.73 0.73	420.00 \$420	16.42 \$16		0.00 \$0	436.42 \$436
TITE MECHANICAL	1	\$420	\$16	5 \$0	\$0	\$436

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Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	=======						
ESTIMATE TOTAL	134	\$6,504	\$2,929	\$411	\$10,000	\$19,844	
SALES TAX MATL MARKUP	0.00% 0.00%	\$0 \$0					
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	\$0	\$0		
TOTAL BEFORE CONTINGENCY	ONTINGENC 10.00%	\$6,504	\$2,929	\$411	\$10,000	\$19,844 \$1,984	
BOND PROFIT	0.00% 10.00%		•			\$0 \$1,984	
JOB TOTAL						\$23,813	

\$23,813

\_\_\_\_\_\_ Estimate: 614X AREA Date: 06-Aug-94

JOB TOTAL

Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #: 94013.02
Sq. footage: SUBMAIN GAS LINE City indx:Louisville, KY

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	st	JMMARY				
	Manhours	Matl	Labor ·	Equipment	Sub	Total
=======================================				:======:		
U02 SITEWORK U15 MECHANICAL	133 1	\$6,084 \$420	\$2,913 \$16	. \$411 \$0	\$10,000 \$0	\$19,408 \$436
TOTAL	134	\$6,504	\$2,929	\$411	\$10,000	\$19,844
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$6,504	\$2,929	\$411	\$10,000	\$19,844 \$1,984 \$0 \$1,984

\_\_\_\_\_ BLDG 6142 Date: 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: 94013.02 Job #: FORT KNOX, KY Location: City indx:Louisville, KY 8100.00 Sq. footage: Description Equipment Manhours Matl Labor \_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 400.00 L.F. 4"DIAMETER 0.00 Unit values 0.15 0.00 3.16 1.29 4.44 \$514 \$0 \$1,776 Totals 60.00 \$0 \$1,262 HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.75 Ton 0.00 380.36 0.00 0.00 380.36 Unit values 14.55 \$0 \$285 \$0 \$0 \$285 10.91 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 200.00 L.F. 1.97 0.24 0.00 0.07 0.00 2.21 Unit values 14.20 \$0 \$395 \$47 \$0 \$442 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 70.00 Ea. DIAMETER PIPE 0.68 0.00 5.55 6.23 Unit values 0.20 0.00 14.00 \$389 \$47 \$0 \$436 \$0 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 1.56 259.60 35.47 5.91 0.00 300.98 Unit values Totals 1.56 \$260 \$35 \$6 \$0 \$301 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 50.00 L.F. END, TAR COAT&WRAP 1"DIAM 1.92 0.17 Unit values 0.11 2.96 5.06 0.00 5.35 \$0 \$253 Totals \$96 \$148 \$9 U02 SITEWORK 107 \$356 \$2,514 \$623 \$0 \$3,493

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Line #	Description	n				
	Manhours	Matl	Labor E	Equipment	Sub	Total
*======================================	======					
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	(See Att	ached for 1.00	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00	0.00	25219.00 \$25,219	25219.00 \$25,219
1562600137	GAS APPLIA			BLE DIAPHR	AGM 1.00	F-a
Unit values Totals	TYPE 1-1/4 0.53 0.53	226.00 \$226	12.10 \$12	0.00	0.00	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$25,219	\$25,457

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Line #		Description	on		<b>_</b>			
		Manhours	Matl	Labor	Equipment	Sub	Total	
=====	=======	========						
ESTIMA'	TE TOTAL	108	\$582	\$2,526	\$623	\$25,219	\$28,950	
SALES 'MATL MILABOR I	ARKUP MARKUP MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0		
TOTAL CONTING		ONTINGENC 10.00% 0.00% 10.00%	\$582 ·	\$2,526	\$623	\$25,219	\$28,950 \$2,895 \$0 \$2,895	
JOB TO	TAL						\$34,740	

Estimate: BLDG 6142

Date:

14-Oct-94

Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:

94013.02

Location: FORT KNOX, KY Job #:
Sq. footage: 8100.00 City inc

Sq. footage: 8100.00 City indx:Louisville, KY

arma/2 537

	SUMMARY					
	Manhours	Matl	Labor	Equipment	Sub	Total
=========	=======		======:			
U02 SITEWORK U15 MECHANICAL	107	\$356 \$226	\$2,514 \$12	\$623 \$0	\$0 \$25,219	\$3,493 \$25,457
TOTAL	108	\$582	\$2,526	\$623	\$25,219	\$28,950
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		ΨV	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,526	\$623	\$25,219	\$28,950 \$2,895 \$0 \$2,895
JOB TOTAL						\$34,740

				.=======		
 Estimate: Description: Project: Location: Sq. footage:	LIMITED EF	HEATING SY EAP (GLASSE KY J	ate: 14 STEM COST E id Date: ob #: 9 ity indx:Lo	STIMATE 94013.02	KY	
Line #	Description	on				
	Manhours	Matl	Labor Eq	quipment	Sub	Total
=======================================	=========	:======	=======================================			
0913100200	AND RECEPT	TACLES	WIRING INCI		340.00	
Unit values Totals	0.15 50.66		4.57 \$1,555	0.00 \$0	0.00 \$0	6.79 \$2,308
0913100200	CO-RAY-VAO	C VANTAGE JIT, WIRE,	2 POWER FEE	EDER INSTA TACLES	LLATION, 120.00	
Unit values Totals	0.15 17.88	2.22 \$266	4.57	0.00		6.79 \$815
A09 ELECTRICAL	69	\$1,019	\$2,104	\$0	\$0	\$3,123

Line #	Description		
			nt Sub Total
===========	:========		
1517010650	W/CDI.GS		10, THREADED, 4" DIAM 330.00 L.F.
Unit values Totals	0.44 4.1° 146.52 \$1,376	7 10.30 0.0 5 \$3,400 \$	0.00 0.00 14.47 0.00 \$0 \$4,776
1517011310	DOD 01D0 10/00 1	/OH DIRK	THRD W/CPLG & HNGR SZD 450.00 L.F.
Unit values Totals	0.13 1.64 57.15 \$738	2.88 0.0 3 \$1,294 \$	0.00 4.52
1519010320	ALUMINUM REFLECTO	ORS W/HANGERS	45.00 Ea.
Unit values Totals	0.50 39.79 22.50 \$1,793	3.80 0.0 L \$171 . \$	00 0.00 43.59 50 \$0 \$1,962
1524105040	VACUUM PUMP AND V	VENT PIPING	1.00 Ea.
Unit values Totals	3.00 738.35 3.00 \$738	120.15 0.0 3 \$120 \$	0.00 858.50
1552301020	CRV-100 GAS FIRE	BURNER, 100 MBH &	COMBUSTION CHAMBER 6.00 Ea.
Unit values Totals	1.00 860.00 6.00 \$5,160	) 44.06 0.0 ) \$264 \$	0.00 Ea. 0.00 904.06 50 \$0 \$5,424
1554510160	CO-RAY-VAC VANTAC	SE 2 INFA-RD HTG UN	NT, GAS 100MBH 1.00 Ea.
Unit values Totals	6.00 1065.00 6.00 \$1,065	163.40 0.0 5 \$163 \$	0.00 1228.40 0.00 \$1,228
1554510220	CO-RAY-VAC VANTAC	SE 2 INFA-RD HTG UNI	T, GAS 40 MBH 4.00 Ea.
Unit values Totals	4.00 935.00 16.00 \$3,740	81.70 0.0 \$327 \$	0.00 1016.70 0.00 \$.0 \$4,067
1556800120	CO-RAY-VAC VANTAC	SE 2 VENT PIPE	5.00 Ea.
Unit values Totals		76.50 0.0 3 \$382 \$	
1574205220	ELECTRIC THERMOST	CAT W/ COVER AND WIR	ING 6.00 Ea.
Unit values Totals	1.00 75.00 6.00 \$450		

Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
	=======							
U15 MECHANICAL	272	\$15,408	\$6,286	\$0	\$0	\$21,694		
1631200100	HEATING	SYSTEM POWE	R / CONT	ROL PANEL	1 00	To.		
Unit values Totals	2.96	330.76 \$331	70.58 \$71	0.00	1.00 0.00 \$0	401.34 \$402		
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402		

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Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========					
1.				* -		
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
SALES TAX	0.00%	\$0 \$0				
MATL MARKUP LABOR MARKUP	0.00% 0.00%	\$0	\$0			
EQUIPT MARKUP	0.00%		, -	\$0		
SUB MARKUP	0.00%				\$0	
	ONTINGENC	\$16,758	\$8,461	\$0	\$0	\$25,219
CONTINGENCY BOND	0.00% 0.00%				•	\$0 \$0
PROFIT	0.00%					\$0 \$0 \$0
JOB TOTAL						\$25,219

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Estimate: BLDG 6142 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBID Date:
LOCATION: FORT KNOX, KY Job #: 94013.02

	Location: Sq. footage:	FORT KNOX	, KI	City indx	:Louisville,	, KY	
		Si	JMMARY				
		Manhours	Matl	Labor	Equipment	Sub	Total
	=======================================	=======	======				
	A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	69 272 3	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$3,123 \$21,694 \$402
	TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
	SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
)	TOTAL BEFORE COCONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0 \$0
	JOB TOTAL						\$25,219

			=======	=======	=========	=======	
	Estimate: Description: Project: Location: Sq. footage:	BLDG 6143 COST ESTIM LIMITED EF FORT KNOX, 8100.00	ATE AP (GLASSB KY J C	ate: id Date: ob #: ity indx:	14-Oct-94 94013.02 Louisville,	KY	
	==========	========	=======	=======		=======	
	Line #	Descriptio					
		Manhours			Equipment		
	=========	========	:=======				
	0205543200	AUDTAMETE	מי		ED CONNECTI	400.00	
	Unit values Totals	0.15 60.00	0.00 \$0	3.16 \$1,262	1.29 \$514	0.00	4.44 \$1,776
	0207180380	HVAC DEMO,	BOILER GA	s/oil sti	>150MBH		<b></b>
	Unit values Totals	12.00 12.00	0.00 \$0	323.82 \$324		1.00 0.00 \$0	323.82
	0207183600	HVAC DEMO	MECH EQPT	HEAVY IT	EM		
	Unit values		0.00		0.00	0.75 0.00 \$0	Ton 380.36 \$285
	0208400600	REMOVE PI				200.00	L.F.
	Unit values Totals	0.07 14.20	0.00 \$0	1.97 \$395	0.24 \$47	0.00	2.21 \$442
	0208401000	DIAMETER I	PIPE	ROM PIPE	FITTING, UP	70.00	
٠.	Unit values Totals	0.20 14.00	0.00 \$0	5.55 \$389	0.68 \$47	\$0	6.23 \$436
	0266907800	CUT IN VAI	LVES, W/DU	CK TIP GA		AMETER 1.00	Ea.
	Unit values Totals	1.56 1.56	259.60 \$260	35.47 \$35	5.91 \$6	0.00	
	0268520550 Unit values Totals	GAS SERVICE END, TAR CO				PLAIN 50.00 0.00 \$0	L.F. 5.06 \$253
	U02 SITEWORK	119	\$356	\$2,838	· \$623	\$0	\$3,817

Line #	Descriptio	n	·			
	Manhours	Matl	Labor	Equipment	Sub	Total
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	N (See Att	ached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0	25219.00	
1562600137	GAS APPLIA TYPE 1-1/4			JBLE DIAPHE	RAGM 1.00	Ea.
Unit values Totals		226.00 \$226	12.10	0.00 \$0	0.00	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$25,219	\$25,457

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
ESTIMATE TOTAL	120	\$582	\$2,850	\$623	\$25,219	\$29,274
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
•	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,850	\$623	\$25,219	\$29,274 \$2,927 \$0 \$2,927
TOR TOTAL						\$35,129

\$35,129

Date:

14-Oct-94

Estimate: BLDG 6143
Description: COST ESTIMATE Project:

LIMITED EEAP (GLASSBid Date:

Location: FORT KNOX, KY
Sg. footage: 8100.00

JOB TOTAL

Job #: 94013.02 City indx:Louisville, KY

Sq. rootage:	0100.00				, ========		
=======================================	Si	SUMMARY					
	Manhours	Matl	Labor	Equipment	Sub	Total	
	========						
U02 SITEWORK U15 MECHANICAL	119	\$356 \$226	\$2,838 \$12	\$623 \$0	\$0 \$25,219	\$3,817 \$25,457	
TOTAL	120	\$582	\$2,850	\$623	\$25,219	\$29,274	
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0		
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,850	\$623	\$25,219	\$29,274 \$2,927 \$0 \$2,927	

Estimate: BLDG 6143 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: 94013.02 Job #: FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description Manhours Matl Labor Equipment 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 340.00 L.F. AND RECEPTACLES 6.79 0.00 0.00 2.22 4.57 0.15 Unit values \$0 \$2,308 \$753 \$1,555 \$0 Totals 50.66 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES
0.15 2.22 4.57 0.00 120.00 L.F. 6.79 0.00 Unit value's \$0 \$0 \$815 \$266 \$549 17.88 Totals A09 ELECTRICAL 69 \$1,019 \$2,104 \$0 \$0 \$3,123

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Line #	Descriptio	n				
	Manhours			Equipment		Total
=======================================	========	=======		=======================================	======:	
1517010650	W/CPLGS			CHEDULE 40,	330.00	L.F.
Unit values Totals	0.44 146.52	4.17 \$1,376	10.30	0.00 \$0		14.47 \$4,776
1517011310	GAS SERVIC	E PIPE ST	EEL GALV DIAM	SCH 40 THR	D W/CPLG 450.00	
Unit values Totals	0.13 57.15	1.64	2.88	0.00	0.00 \$0	
1519010320	ALUMINUM R	EFLECTORS	W/HANGE	RS	45.00	Ea
Unit values Totals	0.50 22.50	39.79 \$1,791			0.00	
1524105040	VACUUM PUM	P AND VEN	T PIPING		1.00	F-2
Unit values Totals	3.00		120.15 \$120		0.00	858.50
1552301020	CRV-100 GA	S FIRED B	URNER, 1	00 MBH & C	OMBUSTION 6.00	CHAMBER
Unit values Totals	1.00 6.00	860.00 \$5,160	44.06 \$264	0.00 \$0	0.00	904.06 \$5,424
1554510160	CO-RAY-VAC	VANTAGE	2 INFA-	RD HTG UNT,	GAS 100M 1.00	BH Ea
Unit values Totals		1065.00 \$1,065		0.00 \$0	0.00	1228.40 \$1,228
1554510220	CO-RAY-VAC	VANTAGE	2 INFA-R	D HTG UNIT,	GAS 40 M 4.00	
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327		0.00	
1556800120	CO-RAY-VAC	VANTAGE	2 VENT P	IPE	5.00	Eo
Unit values Totals	1.60 8.00	70.00 \$350	76.50 \$382		0.00	146.50 \$732
1574205220	ELECTRIC T	HERMOSTAT	W/ COVE	R AND WIRIN	G 6.00	Fa
Unit values Totals	1.00	75.00 \$450	27.55 \$165		0.00 \$0	102.55 \$615

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Line #	Descript	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total			
=======================================	=======	=========	======						
U15 MECHANICAL	272	\$15,408	\$6,286	\$0	\$0	\$21,694			
1631200100	HEATING	SYSTEM POWER	R / CONT	ROL PANEL	1.00	Ea.			
Unit values Totals	2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402			
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402			

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Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================		========	=======	=========		
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%			\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	<b>\$0</b>	\$0	\$25,219 \$0 \$0 \$0
JOB TOTAL						\$25,219

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Estimate: BLDG 6143 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBID Date:

Project:

FORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY

Location: Sg. footage:

Sq. footage:	city max:boursville, ki						
==========	SUMMARY						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================							
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	272	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$3,123 \$21,694 \$402	
TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219	
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0	¢0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0		
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0	
JOB TOTAL						\$25,219	

BLDG 6144 Date: 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: Location: FORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY Sq. footage: 8100.00 \_\_\_\_\_\_ Description Line # Matl Equipment Manhours Labor \_\_\_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 4"DIAMETER 400.00 L.F. Unit values 0.00 0.15 3.16 1.29 0.00 4.44 Totals 60.00 \$0 \$1,262 \$514 \$0 \$1,776 0207183600 HVAC DEMO, MECH EQPT HEAVY ITEM-0.75 Ton Unit values 14.55 0.00 0.00 380.36 0.00 380.36 Totals 10.91 \$0 \$285 \$0 \$0 \$285 0208400600 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 200.00 L.F. 0.00 Unit values 1.97 0.07 0.24 0.00 2.21 Totals 14.20 \$0 \$395 \$47 \$0 \$442 0208401000 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" DIAMETER PIPE 70.00 Ea. Unit values 0.20 0.00 5.55 0.68 0.00 6.23 \$47 Totals 14.00 \$0 \$389 \$0 \$436 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. 259.60 Unit values 1.56 35.47 5.91 0.00 300.98 Totals \$260 1.56 \$35 \$6 \$0 \$301 0268520550 GAS SERVICE&DISTRIB PIPING.SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. Unit values 0.11 1.92 2.96 0.17 0.00 5.06 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 107 \$356 \$2,514 \$623 \$0 \$3,493

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Line #	Description	1			·		
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================							•
1554510245	HTG INFA-RI	UNT GAS	ELEC IGN	(See Atta	ched for 1	•	
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0		25219.00	
1562600137	GAS APPLIANTYPE 1-1/4			BLE DIAPHR	AGM 1.00	Fa	
Unit values Totals		226.00 \$226	12.10 \$12	0.00 \$0	0.00	238.10 \$238	
U15 MECHANICAL	1	\$226	\$12	\$0	\$25,219	\$25,457	

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Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
ESTIMATE TOTAL	108	\$582	\$2,526	\$623	\$25,219	\$28,950	
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0			
SUB MARKUP	0.00%		•		\$0		
TOTAL BEFORE COCONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,526	\$623	\$25,219	\$28,950 \$2,895 \$0 \$2,895	
JOB TOTAL						\$34,740	

\$34,740

Estimate: BLDG 6144

Date: 14-Oct-94

Description: Project:

COST ESTIMATE

LIMITED EEAP (GLASSBid Date:

FORT KNOX, KY Job #: . 94013.02

Location: Sq. footage: 8100.00

JOB TOTAL

The State of the S

City indx:Louisville, KY

SUMMARY Manhours Matl Labor Equipment Sub \$623 \$0 \$3,493 \$2,514 \$356 107 U02 SITEWORK \$12 \$25,219 \$25,457 \$0 \$226 U15 MECHANICAL \$623 \$25,219 \$28,950 \$582 \$2,526 108 TOTAL \$0 0.00% SALES TAX \$0 MATL MARKUP 0.00% \$0 0.00% LABOR MARKUP \$0 EOUIPT MARKUP 0.00% \$0 0.00% SUB MARKUP \$582 \$2,526 \$28,950 \$623 \$25,219 TOTAL BEFORE CONTINGENC \$2,895 CONTINGENCY 10.00% \$0 BOND 0.00% \$2,895 10.00% PROFIT

\_\_\_\_\_\_ Estimate: BLDG 6144 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE LIMITED EEAP(GLASSES Decorations) Description: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description Line # Manhours Matl Labor . Equipment Sub Total 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 340.00 L.F. AND RECEPTACLES 0.00 6.79 4.57 0.00 0.15 2.22 Unit values 50.66 \$753 \$1,555 \$0 \$0 \$2,308 Totals CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. 4.57 0.00 6.79 0.00 2.22 Unit values 0.15 \$0 \$0 \$815 \$266 \$549 Totals 17.88 A09 ELECTRICAL 69 \$1,019 \$2,104 \$0 \$3,123 \$0

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Line #	Description				_	
	Manhours !	Matl	Labor I	Equipment	Sub	Total
						========
1517010650	BLACK STEEL W/CPLGS				HREADED,	4" DIAM L.F.
Unit values Totals	0.44 146.52	4.17 \$1,376	10.30 \$3,400	0.00	0.00	14.47 \$4,776
1517011310	GAS SERVICE FOR CVRG 10	OC 1/2"	DIAM	SCH 40 THRD	W/CPLG & 450.00	HNGR SZD
Unit values Totals	0.13 57.15	1.64 \$738	2.88 \$1,294	0.00 \$0	0.00	4.52 \$2,032
1519010320	ALUMINUM REF	FLECTORS	W/HANGERS			
Unit values Totals		39.79 51,791	3.80 \$171	0.00	45.00 0.00 \$0	Ea. 43.59 \$1,962
1524105040	VACUUM PUMP	AND VENT	PIPING	,	•	
Unit values Totals	3.00 7 3.00	738.35 \$738	120.15 \$120	0.00	1.00 0.00 \$0	Ea. 858.50 \$858
1552301020	CRV-100 GAS	FIRED BU	RNER, 100	MBH & COME	BUSTION	CHAMBER
Unit values Totals		60.00 5,160	44.06 \$264	0.00	6.00 0.00 \$0	Ea. 904.06 \$5,424
1554510160	CO-RAY-VAC V	ANTAGE 2	INFA-RD	HTG UNT, GA		
Unit values Totals		65.00 1,065	163.40 \$163	0.00 \$0	1.00 1 0.00 \$0	Ea. 1228.40 \$1,228
1554510220	CO-RAY-VAC V	ANTAGE 2	INFA-RD	HTG UNIT, GA		
Unit values Totals		35.00 3,740	81.70 \$327	0.00 \$0	4.00 I 0.00 \$0	Ea. 1016.70 \$4,067
1556800120	CO-RAY-VAC V	ANTAGE 2	VENT PIP	E		
Unit values Totals	1.60	70.00 \$350	76.50 \$382	0.00 \$0	5.00 I 0.00 \$0	Ea. 146.50 \$732
1574205220	ELECTRIC THE	RMOSTAT 1	W/ COVER A	AND WIRING	•	_
Unit values Totals	1.00	75.00 \$450	27.55 \$165	0.00	6.00 E 0.00 \$0	Ca. 102.55 \$615

Line #	ine # Description								
	Manhours	Matl	Labor	Equipment	Sub	Total			
=======================================									
U15 MECHANICAL	272	\$15,408	\$6,286	\$0	\$0	\$21,694			
1631200100	HEATING	SYSTEM POWE	R / CONT	ROL PANEL	1.00	Ea.			
Unit values Totals	2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402			
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402			

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
x============	= = = = = = = =							
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219		
SALES TAX MATL MARKUP	0.00%	\$0 \$0	\$0					
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		ŞU	\$0	\$0			
TOTAL BEFORE COCONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0		
JOB TOTAL						\$25,219		

Estimate: BLDG 6144 Date: 14-Oct-94 Description: INFRARED HEATING SYSTEM COST ESTIMATE

Project:

LIMITED EEAP (GLASSBID Date: FORT KNOX, KY Job #:

94013.02

Location: Sq. footage:

City indx:Louisville, KY

Sq. Iootage:							
==========	======= S	UMMARY					
	Manhours	Matl	Labor	Equipment	Sub	Total	
	=======						
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	272	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$3,123 \$21,694 \$402	
TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219	
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0	20			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0		
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0	
JOB TOTAL						\$25,219	

				=======			
	Estimate: Description:	BLDG 6145 COST ESTIN	ATE	Date:	14-Oct-94		
	Project: Location: Sq. footage:	8100.00		CILY IIIUN	. HOUTS ATTIC		
	===========		=======	=======	=======		
•	Line #	Description	on 				
	=======================================	Manhours	Matl	Labor	Equipment	Sub	Total
	==========	========	=======				
	0205543200	SITE REMOV			DED CONNECT	ION, 400.00	L.F.
	Unit values Totals	0.15 60.00		3.16 \$1,262	1.29 \$514	0.00 \$0	
	0207183600	HVAC DEMO	MECH EQF	T HEAVY I	TEM	0.75	Ton
	Unit values Totals	14.55 10.91	0.00 \$0	380.36 \$285	0.00 \$0	0.00	380.36 \$285
	0208400600	REMOVE PI	PE INSULA	•		200 00	T.F.
	Unit values Totals	0.07 14.20	0.00	1.97 \$395	0.24 \$47	0.00	2.21
	0208401000	REMOVE INS			FITTING, U		Fa
	Unit values Totals	0.20 14.00	0.00	5.55 \$389	0.68 \$47	0.00	6.23
	0266907800	CUT IN VA	LVES, W/I	OUCK TIP G	ASKET, 4" D	IAMETER 1.00	Fa
	Unit values Totals	1.56 1.56	259.60 \$260		5.91 \$6	0.00	300.98 \$301
	0268520550	GAS SERVICEND TAR CO	CE&DISTRI	B PIPING,	SCH40 STEEL	PLAIN 50.00	L.F.
	Unit values Totals	GAS SERVICE END, TAR COORDINATE CO. 11 5.35	1.92 \$96	2.96 \$148	0.17 \$9	0.00	5.06
	U02 SITEWORK	107	\$356	\$2,514	\$623	\$0	\$3,493

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Line #	Descriptio	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	======	======			
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	N (See At	tached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0		25219.00
1562600137	GAS APPLIA			JBLE DIAPH	RAGM 1.00	E-a
Unit values Totals	TYPE 1-1/4 0.53 0.53		12.10	0.00	0.00	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$25,219	\$25,457

	=======================================	=======	========		========	
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=========		:=======		=======		
ESTIMATE TOTAL	108	\$582	\$2,526	\$623	\$25,219	\$28,950
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,526	\$623	\$25,219	\$28,950 \$2,895 \$0 \$2,895
JOB TOTAL						\$34,740

\$34,740

Date: 14-Oct-94

Estimate: BLDG 6145
Description: COST ESTIMATE

Project:

LIMITED EEAP(GLASSBid Date:

FORT KNOX, KY

Job #: 94013.02

Location: Sq. footage: 8100.00

JOB TOTAL

City indx:Louisville, KY

SUMMARY Manhours Matl Labor Equipment Sub Total \$0 \$623 \$3,493 U02 SITEWORK \$2,514 107 \$356 \$226 \$12 \$0 \$25,219 \$25,457 U15 MECHANICAL 1 \$2,526 \$623 \$25,219 \$28,950 \$582 108 TOTAL \$0 0.00% SALES TAX 0.00% \$0 MATL MARKUP \$0 0.00% LABOR MARKUP \$0 EQUIPT MARKUP 0.00% \$0 0.00% SUB MARKUP \$623 \$28,950 \$582 \$2,526 \$25,219 TOTAL BEFORE CONTINGENC \$2,895 10.00% CONTINGENCY \$0 0.00% BOND \$2,895 PROFIT 10.00%

A09 ELECTRICAL

Estimate: BLDG 6145 Date: 14-Oct-94 Description: INFRARED HEATING SYSTEM COST ESTIMATE LIMITED EEAP (GLASSBid Date: Project: Location: FORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY Sq. footage: Description \_ Manhours Matl Labor Equipment 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 340.00 L.F. 0.00 6.79 2.22 4.57 0.00 0.15 Unit values \$0 \$753 \$1,555 \$0 \$2,308 Totals 50.66 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. 0.15 2.22 4.57 0.00 0.00 6.79 Unit values \$0 17.88 \$266 \$549 \$0 \$815 Totals

69 \$1,019 \$2,104 \$0

\$0

\$3,123

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Line #	Description				
			Equipment		Total
=======================================	=======================================				=======
1517010650	W/CPLGS		SCHEDULE 40,	330.00 L	
Unit values Totals		4.17 10. L,376 \$3,4		0.00 \$0	14.47 \$4,776
1517011310	GAS SERVICE FOR CVRG 10'C		LV SCH 40 THRE	W/CPLG & 450.00 L	
Unit values Totals	0.13 57.15	1.64 2. \$738 \$1,2	88 0.00 94 \$0	0.00 \$0	4.52 \$2,032
1519010320	ALUMINUM REFI	LECTORS W/HAN	GERS	45.00 E	la .
Unit values Totals		39.79 3. 1,791 \$1	80 0.00 71 \$0	0.00	43.59 \$1,962
1524105040	VACUUM PUMP A	AND VENT PIPI	NG.	1.00 E	a
Unit values Totals	3.00 73 3.00		15 0.00 20 \$0	0.00	858.50 \$858
1552301020	CRV-100 GAS F	FIRED BURNER,	100 MBH & CC	MBUSTION C	
Unit values Totals	1.00 86 6.00 \$5	50.00 44. 5,160 \$2		0.00 \$0	904.06 \$5,424
1554510160	CO-RAY-VAC VA	NTAGE 2 INF	A-RD HTG UNT,	GAS 100MBH 1.00 E	
Unit values Totals		55.00 163. .,065 \$1	40 0.00 63 \$0	0.00	1228.40
1554510220	CO-RAY-VAC VA	NTAGE 2 INFA	-RD HTG UNIT,	GAS 40 MBH 4.00 E	
Unit values Totals		35.00 81. 3,740 \$3		0.00 \$0	1016.70 \$4,067
1556800120	CO-RAY-VAC VA	NTAGE 2 VENT	PIPE	5.00 E	2
Unit values Totals	1.60 7 8.00	70.00 76.1 \$350 \$3		0.00	146.50 \$732
1574205220	ELECTRIC THER	MOSTAT W/ CO	VER AND WIRING	6.00 E	2
Unit values Totals	1.00 7 6.00	75.00 27.5 \$450 \$16		0.00 E 0.00 \$0	102.55 \$615

Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================							
U15 MECHANICAL	272	\$15,408	\$6,286	\$0	\$0	\$21,694	
1631200100	HEATING	SYSTEM POWER	c / CONTE	ROL PANEL	1.00	Ea.	
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402	
III 6 FI.FCTRICAL	3	\$331	\$71	\$0	\$n	\$402	

Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
	=========						
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219	
SALES TAX	0.00%	\$0 \$0					
MATL MARKUP LABOR MARKUP	0.00% 0.00%	\$0	\$0		•		
EQUIPT MARKUP	0.00%		, ,	\$0			
SUB MARKUP	0.00%				\$0		
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	. \$0	\$0	\$25,219 \$0 \$0 \$0	
TOD MOMAT					•		
JOB TOTAL						\$25,219	

Date: - 14-Oct-94

Estimate: BLDG 6145

Description:

INFRARED HEATING SYSTEM COST ESTIMATE LIMITED EEAP (GLASSBID Date:

Project: FORT KNOX, KY Location:

Job #:

Sq. footage:

City indx:Louisville, KY

sq. rootage.						
	S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======	=======		=======================================		
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	69 272 3	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$3,123 \$21,694 \$402
TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$-0	\$25,219 \$0 \$0 \$0 \$0
JOB TOTAL				•		\$25,219

\_\_\_\_\_\_ BLDG 6146 Date: 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: 8100.00 \_\_\_\_\_ Description Line # Labor Equipment Matl Manhours SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 400.00 L.F. 4 "DIAMETER 0.00 4.44 0.00 1.29 Unit values 0.15 3.16 \$0 \$1,262 \$514 \$1,776 Totals 60.00 \$0 HVAC DEMO, BOILER GAS/OIL STL >150MBH 0207180380 1.00 Ea. 0.00 0.00 0.00 323.82 323.82 Unit values 12.00 \$324 \$0 \$0 \$324 \$0 Totals 12.00 HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.75 Ton 0.00 380.36 0.00 380.36 0.00 14.55 Unit values \$0 \$285 \$0 \$0 \$285 Totals 10.91 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 200.00 L.F. 0.24 2.21 Unit values 0.07 0.00 1.97 0.00 \$395 \$47 \$0 \$0 \$442 Totals 14.20 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 70.00 Ea. DIAMETER PIPE 0.00 5.55 0.68 0.00 6.23 0.20 Unit values \$0 \$389 \$47 \$0 \$436 14.00 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 300.98 Unit values 1.56 259.60 35.47 5.91 0.00 Totals \$6 \$0 \$301 1.56 \$260 \$35 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 0.17 0.00 5.06 0.11 2.96 Unit values 1.92 \$9 \$0 \$253 Totals 5.35 \$96 \$148 U02 SITEWORK 119 \$356 \$2,838 \$623 \$0 \$3,817

	Line #	Description						
		Manhours	Matl	Labor E	quipment	Sub	Total	
	1554510245	HTG INFA-RD	UNT GAS	ELEC IGN	(See Atta	ached for	Breakdown)	
	Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0	25219.00 \$25,219	25219.00 \$25,219	
	1562600137	GAS APPLIANCE REGULATORS DOUBLE DIAPHRAGM TYPE 1-1/4" PIPE SIZE 1.00 Ea.						
	Unit values Totals		226.00 \$226	12.10 \$12	0.00 \$0	0.00	238.10 \$238	
	U15 MECHANICAL	1	\$226	\$12	\$0	\$25,219	\$25,457	

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================	=======================================							
ESTIMATE TOTAL	120	\$582	\$2,850	\$623	\$25,219	\$29,274		
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0					
EQUIPT MARKUP SUB MARKUP	0.00%			\$0	\$0			
TOTAL BEFORE C CONTINGENCY BOND	ONTINGENC 10.00% 0.00%	\$582	\$2,850	\$623	\$25,219	\$29,274 \$2,927 \$0		
PROFIT	10.00%					\$2,927		
JOB TOTAL		•				\$35,129		

Estimate: BLDG 6146 Date: · 14-Oct-94

Description: COST ESTIMATE

Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #: 94013.02

Sq. footage: 8100.00 City indx:Louisville, KY

SUMMARY

	50					
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	:======	======			
U02 SITEWORK U15 MECHANICAL	119 1	\$356 \$226	\$2,838 \$12	\$623 \$0	\$0 \$25,219	\$3,817 \$25,457
TOTAL	120	\$582	\$2,850	\$623	\$25,219	\$29,274
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		1.	\$0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,850	\$623	\$25,219	\$29,274 \$2,927 \$0 \$2,927
JOB TOTAL						\$35,129

				=========				
Description:	LIMITED EE	LDG 6146 Date: 14-Oct-94 NFRARED HEATING SYSTEM COST ESTIMATE IMITED EEAP(GLASSBID Date: ORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY						
Line #	Description	on						
	Manhours	Matl	Labor E	quipment	Sub	Total		
=======================================	=======	:=======						
0913100200	115V, 20 A		wiring inc	L CONDUIT,	WIRE, 340.00	L.F.		
Unit values Totals	0.15	2.22	4.57 \$1,555	0.00	0.00 \$0	6.79 \$2,308		
0913100200	CO-RAY-VAC	VANTAGE	2 POWER FE AND RECEP	EDER INSTAI TACLES	LLATION, 120.00	L.F.		
Unit values Totals	0.15 17.88	2.22	4.57	0.00	0.00 \$0	6.79 \$815		
A09 ELECTRICAL	69	\$1,019	\$2,104	\$0	\$0	\$3,123		

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Line #	Description	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========		=,======	========		
1517010650		L RADIANT	PIPE, SC	CHEDULE 40,	THREADED,	4" DIAM
Unit values Totals	W/CPLGS 0.44 146.52	4.17 \$1,376	10.30 \$3,400	0.00 \$0	0.00	14.47 \$4,776
1517011310	GAS SERVICE FOR CVRG 1	E PIPE ST	EEL GALV	SCH 40 THRI	W/CPLG 8 450.00	HNGR SZD L.F.
Unit values Totals	0.13 57.15	1.64 \$738	2.88 \$1,294	0.00	0.00	
1519010320	ALUMINUM R	REFLECTORS	W/HANGER	RS	45.00	Ea.
Unit values Totals	0.50 22.50	39.79 \$1,791	3.80 \$171	0.00 \$0	0.00	43.59 \$1,962
1524105040	VACUUM PUM	IP AND VEN	T PIPING		1.00	T-2
Unit values Totals	3.00	738.35 \$738	120.15 \$120	0.00 \$0	0.00	858.50 \$858
1552301020	CRV-100 GA	S FIRED B	URNER, 10	00 MBH & CO	MBUSTION 6.00	CHAMBER
Unit values Totals	1.00 6.00	860.00 \$5,160	44.06 \$264	0.00	0.00	904.06 \$5,424
1554510160	CO-RAY-VAC	C VANTAGE	2 INFA-F	RD HTG UNT,	GAS 100ME 1.00	BH Ea
Unit values Totals	6.00 6.00	1065.00 \$1,065	163.40 \$163	0.00 \$0	0.00	
1554510220	CO-RAY-VAC	VANTAGE	2 INFA-RI	HTG UNIT,	GAS 40 ME 4.00	
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327	0.00 \$0		1016.70 \$4,067
1556800120	CO-RAY-VAC	: VANTAGE	2 VENT PI	PE	5.00	F-3
Unit values Totals	1.60 8.00	70.00 \$350	76.50 \$382	0.00 \$0	0.00	146.50 \$732
1574205220	ELECTRIC I	HERMOSTAT	W/ COVER	AND WIRING	6.00	Ea
Unit values Totals	1.00	75.00 \$450	27.55 \$165	0.00	0.00	102.55 \$615

Line #	Descript	ion				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
U15 MECHANICAL	272	\$15,408	\$6,286	\$0	\$0	\$21,694
1631200100	HEATING	SYSTEM POWE	R / CONT	ROL PANEL	1.00	Fa
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
==========	=======	=======						
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219		
SALES TAX MATL MARKUP	0.00% 0.00%	\$0 \$0						
LABOR MARKUP	0.00%	4	\$0	A -				
EQUIPT MARKUP	0.00%			\$0	Ċ0			
SUB MARKUP	0.00%				\$0			
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0		
JOB TOTAL						\$25,219		

Estimate: BLDG 6146

Date: 14-Oct-94

Description:

INFRARED HEATING SYSTEM COST ESTIMATE LIMITED EEAP (GLASSBid Date:

Project: Location:

FORT KNOX, KY

Job #:

94013.02

Sg. footage:

City indx:Louisville, KY

Sq. Iootage.						
=======================================	======= S	UMMARY	======			
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======	======	=======			
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	69 272 3	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$.0 \$.0 \$.0	\$3,123 \$21,694 \$402
TOTAL	344	\$16,758	\$8,461	. \$0	\$0	\$25,219
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0
JOB TOTAL						\$25,219

BLDG 6147 Date: Estimate: . 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY 8100.00 Sq. footage: Description Line # Matl Labor Equipment Sub Manhours \_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 4"DIAMETER 400.00 L.F. Unit values 0.15 0.00 3.16 1.29 0.00 4.44 60.00 \$0 Totals \$1,262 \$514 \$0 \$1,776 0207183600 HVAC DEMO, MECH EOPT HEAVY ITEM 0.75 Ton 0.00 Unit values 14.55 0.00 380.36 0.00 380.36 Totals 10.91 \$0 \$285 \$0 \$0 \$285 0208400600 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 200.00 L.F. Unit values 0.07 0.00 1.97 0.24 0.00 2.21 Totals 14.20 \$0 \$395 \$47 \$0 \$442 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 70.00 Ea. 0.00 5.55 0.68 0.00 0.20 6.23 Unit values \$0 \$389 \$47 14.00 \$0 Totals \$436 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 259.60 35.47 5.91 Unit values 1.56 0.00 300.98 Totals 1.56 \$6 \$260 \$35 \$0 \$301 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 END, TAR COAT&WRAP 1"DIAM 50.00 L.F. Unit values 0.11 1.92 2.96 0.17 0.00 5.06 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 107 \$356 \$2,514 \$623 \$0 \$3,493

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Line #	Description	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
		======				
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	N (See Att	tached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0	25219.00	25219.00 \$25,219
1562600137	GAS APPLIA			JBLE DIAPHI		<b>n</b> .
Unit values Totals	TYPE 1-1/4 0.53 0.53		12.10 \$12	0.00 \$0	1.00 0.00 \$0	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	. \$0	\$25,219	\$25,457

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	Linė #	Description	Description .						
		Manhours	Matl	Labor	Equipment	Sub	Total	•	
	=======================================	=======================================			<del></del>			;	
	ESTIMATE TOTA	L 108	\$582	\$2,526	\$623	\$25,219	\$28,950		
	SALES TAX MATL MARKUP	0.00%	\$0 \$0	**					
	LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	\$0	\$0			
	TOTAL BEFORE CONTINGENCY BOND PROFIT	CONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,526	\$623	\$25,219	\$28,950 \$2,895 \$0 \$2,895		
	JOB TOTAL						\$34.740		

\_\_\_\_\_\_\_\_ Estimate: BLDG 6147 Date: 14-Oct-94

Description: Project:

COST ESTIMATE

LIMITED EEAP(GLASSBid Date: FORT KNOX, KY Job #: 94013.02

Location: Sq. footage: 8100.00

JOB TOTAL

City indx:Louisville, KY

SUMMARY Manhours Matl Labor Equipment Sub

\$2,514 \$623 U02 SITEWORK 107 \$356 \$3,493 \$25,219 \$25,457 U15 MECHANICAL \$12 \$0 \$226 1 \$582 \$2,526 \$623 \$25,219 \$28,950 108 TOTAL \$0 SALES TAX 0.00% 0.00% \$0 MATL MARKUP \$0 0.00% LABOR MARKUP \$0 EQUIPT MARKUP 0.00% \$0 SUB MARKUP 0.00% \$623 \$582 \$2,526 \$25,219 \$28,950 TOTAL BEFORE CONTINGENC \$2,895 CONTINGENCY 10.00% \$0 0.00% BOND \$2,895 10.00% PROFIT

\$34,740

Estimate: BLDG 6147 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: 94013.02 FORT KNOX, KY Job #: Location: City indx:Louisville, KY Sq. footage: Description Line # -----Labor Equipment Manhours Matl 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 340.00 L.F. AND RECEPTACLES 4.57 6.79 2.22 0.15 0.00 0.00 Unit values 50.66 \$753 \$1,555 \$0 \$0 \$2,308 Totals CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. 2.22 4.57 0.00 Unit values 0.15 0.00 Totals 17.88 \$266 \$549 \$0 \$0 \$815 \$2,104 \$0 A09 ELECTRICAL 69 \$1,019 \$0 \$3,123

=======================================	=======	========	======			
Line #	Description	on				
	Manhours	Matl	Labor	Equipmen	t Sub	Total
1517010650	BLACK STEE	EL RADIANT	PIPE,	SCHEDULE 4	0, THREADED	, 4" DIAM L.F.
Unit values Totals	W/CPLGS 0.44 146.52	4.17 \$1,376	10.3 \$3,40	0.0	0.00	14.47 \$4,776
1517011310	GAS SERVICE FOR CVRG	CE PIPE ST	EEL GAL	V SCH 40 T	HRD W/CPLG 450.00	& HNGR SZD L.F.
Unit values Totals	FOR CVRG 1 0.13 57.15		2.8 \$1,29	8 0.0 4 \$	0.00 0 \$0	4.52
1519010320	ALUMINUM F	REFLECTORS	W/HANG	ERS	45.00	Ea.
Unit values Totals	0.50 22.50	39.79 \$1,791	3.8 \$17	0.0 1 \$	0.00	43.59 \$1,962
1524105040	VACUUM PUN	MP AND VEN	T PIPIN	G	1.00	Ea.
Unit values Totals	3.00	738.35 \$738		5 0.0 0 \$	0.00	
1552301020						
Unit values Totals	1.00	860.00 \$5,160	44.0 \$26	6 0.0 4 \$	0 0.00 0 \$0	904.06 \$5,424
1554510160	CO-RAY-VA	C VANTAGE			7 00	BH Ea.
Unit values Totals	6.00 6.00	1065.00 \$1,065	163.4 \$16	0.0 3 \$	0 0.00	1228.40 \$1,228
1554510220	CO-RAY-VA	C VANTAGE	2 INFA-		4 00	BH Ea.
Unit values Totals	4.00 16.00	935.00 \$3,740	81.7 \$32	0.0 7 \$		1016.70
1556800120	CO-RAY-VA	C VANTAGE	2 VENT	PIPE .	5.00	Fa
Unit values Totals	1.60 8.00	70.00 \$350	76.5 \$38			146.50
1574205220	ELECTRIC T	THERMOSTAT	W/ COV	ER AND WIR		Ea.
Unit values Totals	1.00	75.00 \$450	27.5 \$16			102.55

Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
			44 004	4.0				
U15 MECHANICAL	272	\$15,408	\$6,286	. \$0	\$0	\$21,694		
1631200100	HEATING	SYSTEM POWE	ER / CONT	ROL PANEL		_		
·	2 06	330.76	70.58	0.00	1.00	Ea. 401.34		
Unit values Totals	2.96 2.96	\$331	\$71	\$0	\$0	\$402		
III6 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402		

	=======	========			========			
Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219		
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0					
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%		•	\$0	\$0			
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0 \$0		
JOB TOTAL			•			\$25.219		

Estimate: BLDG 6147

Date:

14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Page 5

Description: INFRARED HEATING STOLE.

Project: LIMITED EEAP (GLASSBid Date:

Job #:

FORT KNOX, KY

Location:

Job #: 94013.02 City indx:Louisville, KY

Sq. footage:			City inax	: Louisville,	KY	
==========	======= S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
==========	=======					
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	272	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$3,123 \$21,694 \$402
TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0		
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0 \$0
JOB TOTAL						\$25,219

# **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAGE 1	E 1 OF 3
BUILDING NUMBER:	6113	I	BUILDING I OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATURE URE		60 F 1 F 59 F		
INFILTRATION LOSSES =	-	_ AIR CHGS X	114900	VOL (CUFT) X	29	F TEMP DIFF X 0.019	 	0.13	MBTU/HR
FLOOR LOSSES =	350	LINEAR	INEAR FEET OF PERIMETER	RIMETER X	59	F TEMP DIFF X 0.81	n	0.02	MBTU/HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069	6900 AREA (SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.04	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.07	MBTU / HR
CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.01	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	н	90.0	MBTU / HR
TINTED DBL PANE WIN'W =	•	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	. 69	F TEMPERATURE DIFFERENCE	11	00.00	MBTU / HŔ
METAL ROLL UP DOORS =	1344	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	И	0.04	MBTU/HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	n	00.00	MBTU/HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	Ħ	00.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	R	0.00	MBTU/HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR

MBTU / HR MJ/HR

0.37 388.28

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TOTAL BASELINE HEAT LOSSES

	iL.	FT KNOX	LIMIT	NOX LIMITED EEAP (GLASS)	9	LASS)			
	EC	ECO - 1: INFR	ARED	: INFRARED HEATING CALCULATIONS	rcn	LATIONS			
								PAGE 2	2 OF 3
BUILDING NUMBER:	6113		BUILDING OUTSIDE TEMPER	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUR TURE	55	<u>ши.</u> ш.		
INFILTRATION LOSSES =	<del>-</del>	AIR CHGS X	( 114900	VOL (CUFT) X	54	F TEMP DIFF X 0.019	11	0.12	MBTU / HR
FLOOR LOSSES =	350	LINEAR	FEET OF P	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	H	0.02	MBTU / HR
SURFACE HEAT LOSSES									
FLAT BUILT UP ROOF =	0069	· AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.04	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
CORR MTL PNL WALL =	1165	AREA (SF) X	( 0.17	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	п	0.01	MBTU / HR
CLR SGL PANÉ WINDOWS =	760	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	II	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	я	0.00	MBTU / HR
METAL ROLL UP DOORS =	1344	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.04	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X	( 0.214	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	Ħ	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	ł	0.00	MBTU / HR
							J		

MBTU / HR MJ/HR

0.34 355.37

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TOTAL ECO HEAT LOSSES

## ECO - 1: INFRARED HEATING CALCULATIONS

PAGE 3 OF 3

BASELINE	ECO - 1
%09	%06
OUTSIDE DESIGN TEMP (F) 1	-
HTG TEMP SETPOINT (F) 60	55
HEATING DEGREE DAYS 4616	3396
700	70.0
70.0	0.54
\$6.60	\$6.60
\$ /MBTU -NATURAL GAS \$4.62	\$4.62
\$10.84	\$10.84
	0.37 66.60 64.62 10.84

	GLOSSARY OF TERMS			.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2
6113	GLOSS,			AB PERIMET	RICAL CORR	M ASHRAE
BUILDING NUMBER		1 MBTU = 1055 MJ	0.019=CONSTANT	.81 = CONSTANT FOR SL	CORR FACTOR = EMPIF	65 F DEGREE-DAYS FRO

	ANNUAL HEATING	ATING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	DEGREE 1	λAζ	METHO	()	
BASELINE =	0.37	MBTU/HR X 461 SYS EFF X 59	MBTU/HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	HRS/DAY	п	1,151.76	MBTU/YR	
	1,151.76	MBTU/YR X	CORR FACTOR	-	Ħ		1,151.76	MBTU/YR
ECO - 1 ==	0.34	MBTU/HR X 339 SYS EFF X 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	HRS/DAY	• H	564.90	MBTU/YR	
	564.90	MBTU/YR X	CORR FACTOR	_	н	ı	564.90	MBTUMR
	ECO - 1 ANNU	ANNUAL HEATING	AL HEATING ENERGY CONSUMPTION SAVINGS	ON SAVINGS	11 11		586.86 619,135.94	MBTUMR

	ANNUAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST			
BASELINE =	1,151.76	MBTU/YR X 6.6	9.9	\$ /MBTU	II	7,601.62 \$ MR	\$ /7R
ECO - 1 =	564.90	MBTU/YR X 4.62	4.62	\$ /MBTU	Ħ	2,609.84 \$ MR	\$ MR
	ECO - 1 ANNL	JAL HEATING E	NERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS =	11	4.991.77 \$ /YR	\$ MR

## ECO - 1: INFRARED HEATING CALCULATIONS

	BUILDING NUMBER:	6114		BUILDING F OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATURE		60 F 1 F 59 F	PAGE	PAGE 1 OF 3
	INFILTRATION LOSSES =	-	AIR CHGS X	114900	VOL (CUFT) X	29	F TEMP DIFF X 0.019	     6	0.13	MBTU / HR
	FLOOR LOSSES=_	350	LINEAR	LINEAR FEET OF PERIMETER	RIMETER X	29	F TEMP DIFF X 0.81	n	0.02	MBTU / HR
	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069	6900 AREA(SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.04	MBTU / HR
	FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
	8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.07	MBTU / HR
	CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.01	MBTU / HR
	CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235	U ·VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	. 90.0	MBTU / HR
	TINTED DBL PANE WIN'W =		AREA (SF) X	0.65	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE		0.00	MBTU / HR
	METAL ROLL UP DOORS =	1344	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	n	0.04	MBTU / HR
Σ	METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	П	0.00	MBTU / HR
	LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
	METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	R	0.00	MBTU / HR
_	MTL/ GLAZED·PERSONNEL= 	25	AREA (SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
								1		

MBTU / HR MJ/HR

0.37 388.28

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**TOTAL BASELINE HEAT LOSSES** 

# ECO - 1: INFRARED HEATING CALCULATIONS

2 OF 3		MBTU / HR	MBTU / HR		MBTU/HR	MBTU / HR										
PAGE 2 OF		0.12	0.02		0.04	0.00	90.0	0.01	0.05	0.00	0.04	0.00	0.00	0.00	0.00	
	LLL	11	11		н	n	п	11	п	п	п	II	11	П	R	
	RE SETPOINT: 55	F TEMP DIFF X 0.019	F TEMP DIFF X 0.81		F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE									
	ZATU NTURI	54	54		24	54	54	54	54	54	54	54	54	54	54	
	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	VOL (CUFT) X	PERIMETER X		U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	
	BUILDING OUTSIDE TEMPER	114900	LINEAR FEET OF F		0.105	0.176	0.389	0.17	1.235	0.65	0.56	0.214	0.56	0.56	0.615	
		×	RFE		×	×	×	×	×	·×	×	×	×	×	×	
		AIR CHGS	LINEA		AREA (SF)											
	6114	<del>-</del>	350		0069	0	2936	1165	760	0	1344	0	0	0	25	
	BUILDING NUMBER:	INFILTRATION LOSSES =	FLOOR LOSSES =	SURFACE HEAT LOSSES	FLAT BUILT UP ROOF =	FACE BRICK/BLK WALL =	8" CINDER BLOCK WALL =	CORR MTL PNL WALL =	CLR SGL PANE WINDOWS =	TINTED DBL PANE WIN'W =	METAL ROLL UP DOORS =	WOOD GLAZED O'HEAD DR =	LG MTL SLIDING DOOR =	METAL PERSONNEL DR=	MTL/ GLAZED PERSONNEL=	

MBTU / HR MJ/HR

0.34 355.37

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 3 OF 3

,									
	ECO - 1	%06	-	52	3396	0.34	\$6.60	\$4.62	\$10.84
	BASELINE	%09	τ-	09	4616	0.37	\$6.60	\$4.62	\$10.84
		SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES (MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MBTU -PPG

BUILDING NUMBER	6114
	GLOSSARY OF TERMS
1 MBTU = 1055 MJ	
0.019=CONSTANT	
.81 = CONSTANT FOR SLAB	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIRIC	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FROM	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

A	ANNUAL HEATING	TING ENERG	3Y C	ENERGY CONSUMPTION (DEGREE DAY METHOD)	DEGREE [	JAY	METHO	(c	
BASELINE =	0.37	MBTU/HR X 4	1616	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY	HRS/DAY				
	9.0	SYS EFF X	59	TEMP DIFFERENCE		11	1,151.76	MBTUYR	
•	1,151.76	MBTU/YR	×	CORR FACTOR	_	н		1,151.76	MBTU/YR
ECO - 1 =	0.34	MBTU/HR X 3	3396	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY	HRS/DAY				-
·	0.0	SYS EFF X	54.	EFF X 54. TEMP DIFFERENCE		11	564.90	MBTUYR	
	564.90	MBTU/YR	×	CORR FACTOR	_	11		564.90	MBTU/YR
	ECO - 1	ANNUAL HEATIN	IG EN	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	N SAVINGS	11 H		586.86 619,135.94	MBTUMR

	ANNUAL	<b>ANNUAL HEATING ENERGY COST</b>	:NERG)	COST				
3ASELINE =	1,151.76	MBTU/YR X 6.6	6.6	\$ /MBTU	11	= 7,601.62 \$ /YR	\$ YR	
11	564.90	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,609.84 \$ MR	\$ MR	
	ECO - 1 ANNL	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 4.991.77 \$ //R	ENERGY C	OST SAVINGS	11	4.991.77	S YR	

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAGE	PAGE 1 OF 3
BUILDING NUMBER:	6115		BUILDING H OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURI JRE	SETPOINT: 60 F	<u>пт пт'нт</u> 1		
INFILTRATION LOSSES =	-	AIR CHGS X	114900	VOL (CUFT) X	29	F TEMP DIFF X 0.019	tt .	0.13	MBTU / HR
FLOOR LOSSES =	350	LINEAR	LINEAR FEET OF PERIMETER	RIMETER X	59	F TEMP DIFF X 0.81	"	0.02	MBTU / HR
SURFACE HEAT LOSSES		·							
FLAT BUILT UP ROOF =	0069	AREA (SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	H	0.04	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.07	MBTU / HR
CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	п	0.01	MBTU / HR
CLR SGL PANE WINDOWS =	760	· AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	90.0	MBTU/HR
TINTED DBL PANE WIN'W =		AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
METAL ROLL UP DOORS =	1344	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.04	MBTU / HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	Ħ	0.00	MBTU/HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
				TOTAL BASEL	N N	TOTAL BASELINE HEAT LOSSES	11 11	0.37 388.28	MBTU / HR MJ/HR

## ECO - 1: INFRARED HEATING CALCULATIONS

							-		
SNO III	7440							PAGE 2 OF	2 OF 3
	0	·	BUILDIN OUTSIDE TEMPER	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	SATU TURE	RE SETPOINT: 55 F			
INFILTRATION LOSSES =	-	AIR CHGS X	114900	VOL (CU FT) X 54 F TEMP DIFF	54 F	X 0.019	11	0.12	MBTU / HR
FLOOR LOSSES =	350	LINEAR FE	ET OF F	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	п	0.02	MBTU / HR
SURFACE HEAT LOSSES									
FLAT BUILT UP ROOF =	0069	AREA (SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.04	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	HR-SF-F) X	54	RE	R	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	H	0.01	MBTU / HR
CLR SGL PANE WINDOWS =	260	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE.		0.00	MBTU / HR
METAL ROLL UP DOORS =	1344	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.04	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE :	п	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	00.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR

MBTU / HR MJ/HR

0.34 355.37

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ECO - 1: INFRARED HEATING CALCULATIONS

PAGE 3 OF 3

. ,										
	ECO - 1	%06	-	92	3396	0.34		\$6.60	\$4.62	\$10 RA
	BASELINE	%09	-	09	4616	0.37	5	\$6.60	\$4.62	£10 84
		SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	(MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	Cad LITOW &

GLOSSARY OF TERMS  1 MBTU = 1055 MJ  0.019=CONSTANT  .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE  CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS  65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	BUILDING NUMBER 6115
1 MBTU = 1055 MJ 0.019=CONSTANT .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	GLOSSARY OF TERMS
0.019=CONSTANT .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE .CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS .65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	1 MBTU = 1055 MJ
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	0.019=CONSTANT
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

A	NNUAL HEA	TING ENER	3Y C	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	(DEGREE I	JAY	METHOI	(0	
BASELINE =	0.37	MBTU/HR X SYS EFF X	4616 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	4 HRS/DAY	II	1,151.76	MBTUMR	
	1,151.76	MBTU/YR	×	CORR FACTOR		н		1,151.76	MBTUMR
ECO - 1 =	0.34	MBTU/HR X SYS EFF X	3396	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE .	4 HRS/DAY	11	564.90	MBTU/YR	
	564.90	MBTU/YR	×	CORR FACTOR	<del></del>	11		564.90	MBTUMR
	ECO - 1	ANNUAL HEATI	NG E	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	ION SAVINGS	n n		586.86 619,135.94	MBTU/YR MJ/YR

	ANNOAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST			
BASELINE =	1,151.76	MBTU/YR X 6.6	6.6	\$ /MBTU	ŧi	= 7,601.62 \$ MR	\$ MR
ECO - 1 =	564.90	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,609.84 \$ /YR	\$ /YR
	FCO - 1 ANNI	FCO - 1 ANNIJAL HEATING ENERGY COST SAVINGS = 4.991.77 \$ /YR	ENERGY (	SOST SAVINGS	11	4.991.77	\$ ∧R

#### PAGE 1 OF 3 0.02 90.0 0.00 0.13 0.04 0.00 0.07 0.01 0.00 0.04 0.00 H II 59 F 00 0.019 F TEMP DIFF X 0.81 TEMPERATURE **TEMPERATURE** TEMPERATURE TEMPERATURE TEMPERATURE TEMPERATURE DIFFERENCE TEMPERATURE DIFFERENCE TEMPERATURE **TEMPERATURE** DIFFERENCE. DIFFERENCE DIFFERENCE DIFFERENCE DIFFERENCE DIFFERENCE DIFFERENCE × **ECO - 1: INFRARED HEATING CALCULATIONS** FT KNOX LIMITED EEAP (GLASS) F TEMP DIFF BUILDING HEATING TEMPERATURE SETPOINT: ட u **OUTSIDE DESIGN TEMPERATURE** 59 59 59 59 TEMPERATURE DIFFERENCE VOL (CUFT) X U VALUE (BTU/ U VALUE (BTU/ U VALUE (BTU/ J VALUE (BTU/ U VALUE (BTU/ U VALUE (BTU/ HR - SF - F) X U VALUE (BTU/ U VALUE (BTU/ U VALUE (BTU/ HR - SF - F) X HR-SF-F) X HR.SF.F) X HR-SF-F) X HR - SF - F) X HR - SF - F) X HR-SF-F) X HR-SF-F) X × LINEAR FEET OF PERIMETER 114900 0.105 0.176 0.389 1.235 0.214 0.65 0.56 0.56 0.17 AIR CHGS X AREA (SF) X × × × × × $\times$ × AREA (SF) 6116 6900 2936 1165 1344 350 760 FLOOR LOSSES = INFILTRATION LOSSES = FLAT BUILT UP ROOF = 8" CINDER BLOCK WALL = CORR MTL PNL WALL = CLR SGL PANE WINDOWS = METAL ROLL UP DOORS = TINTED DBL PANE WIN'W = METAL GLAZED O'HEAD DR = FACE BRICK/BLK WALL LG MTL SLIDING DOOR SURFACE HEAT LOSSES BUILDING NUMBER:

MBTU / HR

0.00

MBTU / HR

0.00

TEMPERATURE

29

U VALUE (BTU/ HR - SF - F) X

0.615

×

AREA (SF)

25

MTL/ GLAZED PERSONNEL=

DIFFERENCE

U VALUE (BTU/ HR - SF - F) X

0.56

×

AREA (SF)

METAL PERSONNEL DR=

MBTU / HR

MJ/HR

388.28

0 0

**TOTAL BASELINE HEAT LOSSES** 

0.37

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAGE 2 OF	2 OF 3
BUILDING NUMBER:	6116		BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TUR	55	<u> </u>		
INFILTRATION LOSSES =	-	AIR CHGS X	114900	VOL (CUFT) X 5	54 F	F TEMP DIFF X 0.019	11	0.12	MBTU/HR
FLOOR LOSSES =	350	LINEAR FE	ET OF PE	LINEAR FEET OF PERIMETER X 5	54 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069	AREA (SF) X	0.105	U VALUE (BTU/ 5 HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	n	0.04	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	ŧI	90.0	MBTU / HR
CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.01	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235	U VALUE (BTU/ 5 HR - SF - F) X	54.	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
METAL ROLL UP DOORS =	1344	AREA (SF) X	0.56	U VALUE (BTU/ FHR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.04	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X	0.214	U VALUE (BTU/ E HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ E HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X 5	54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
									1

MBTU / HR MJ/HR

0.34 355.37

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## ECO - 1: INFRARED HEATING CALCULATIONS

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6116

	BASELINE	ECO - 1	BUILDING NUMBER
SYSTEM EFFICIENCY	%09	%06	
OUTSIDE DESIGN TEMP (F)	-	-	1 MBTII = 1055 M I
HTG TEMP SETPOINT (F)	09	55	TIMETONIO COLORO
HEATING DEGREE DAYS	4616	3396	81 = CONSTANT FOR SIVE
TOTAL HEAT LOSSES	0		EACTOR EACTOR
(MBTU/HR)	0.37	0.34	
\$ /MBTU -FUEL OIL	\$6.60	\$6.60	מו הביטורים ואס
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62	
\$ /MBTU -PPG	\$10.84	\$10.84	

GLOSSARY OF TERMS	1 MBTU = 1055 MJ	0.019=CONSTANT	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAF	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING FFEECT VS	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28 2
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	ANNUAL HEA	ATING ENERG	ĭ ∠	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	DEGREE I	JAY	METHOI	()	
BASELINE =	0.37	MBTU/HR X 46 SYS EFF X 5	516 59 T	TU/HR X 4616 DEGREE DAYS X 24 HRS/DAY EFF X 59 TEMP DIFFERENCE	HRS/DAY	11	1,151.76	MBTU/YR	
	1,151.76	MBTU/YR .	×	CORR FACTOR	-	11	•	1,151.76	MBTUMR
ECO - 1=	0.34	MBTU/HR X 33 SYS EFF X 5	396 54 T	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	HRS/DAY		564.90	MBTU/YR	
	564.90	MBTU/YR	×	CORR FACTOR	<b>4</b>	Ħ	'	564.90	MBTUMR
	ECO - 1	ANNUAL HEATING	G EN!	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	ON SAVINGS	11 11		586.86 619.135 94	MBTUYR

		ANNUAL	<b>ANNUAL HEATING ENERGY COST</b>	ENERGY	COST			
œ	3ASELINE =	1,151.76	MBTU/YR X 6.6	9.0	\$ /MBTU	п	= 7,601.62 \$ /YR	\$ /YR
	ECO - 1 =	564.90	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,609.84 \$ /YR	\$ MR
		ECO - 1 ANNL	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 4,991.77 \$ MR	NERGY C	OST SAVINGS	II	4.991.77	S VR

# **ECO - 1: INFRARED HEATING CALCULATIONS**

•									PAGE 1	1 OF 3
	BUILDING NUMBER:	6117	1	BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATURE URE	60	<u> </u>		
	INFILTRATION LOSSES =	-	_ AIR CHGS ·X	X 114900	VOL (CUFT) X	59	F TEMP DIFF X 0.019	"	0.13	MBTU / HR
	FLOOR LOSSES =	350	LINEAF	LINEAR FEET OF PERIMETER	ERIMETER X	29	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069	AREA (SF)	X 0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.04	MBTU / HR
	FACE BRICK/BLK WALL =	-	AREA (SF)	X 0.176	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	Ħ	0.00	MBTU / HR
	8" CINDER BLOCK WALL =	2936	AREA (SF)	X 0.389	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	Ħ	0.07	MBTU / HR
	CORR MTL PNL WALL =	1165	AREA (SF)	X 0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	ŧı	0.01	MBTU / HR
	CLR SGL PANE WINDOWS =	760	AREA (SF)	X 1.235	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	n	90.0	MBTU'I HR
	TINTED DBL PANE WIN'W =		AREA (SF)	X . 0.65	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
	METAL ROLL UP DOORS =	1344	AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.04	MBTU/HR
	METAL GLAZED O'HEAD DR =		AREA (SF)	X 0.214	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	н	00.00	MBTU / HR
	LG MTL SLIDING DOOR =		AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
	METAL PERSONNEL DR≈		AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
	MTL/ GLAZED PERSONNEL=	25	AREA (SF)	X 0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	и	0.00	MBTU/HR
	1		I		1			İ		

MBTU / HR MJ/HR

0.37 388.28

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TOTAL BASELINE HEAT LOSSES

# **ECO - 1: INFRARED HEATING CALCULATIONS**

BUILDING NUMBER:	6117		BUILDING	BUILDING HEATING TEMPERATURE SETPOINT:	AATUI	RE SETPOINT: 55	 	PAGE 2	2 OF 3
			OUTSIDE	OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE				
<del></del>	AIR CHGS	SS X	114900	VOL (CUFT) X	54	F TEMP DIFF X 0.019	11	0.12	MBTU / HR
350	I I N	EAR FE	LINEAR FEET OF PE	PERIMETER X	54 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
0069	AREA (SF)	SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.04	MBTU / HR
0	AREA (SF)	3F) X	0.176	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
2936	AREA (SF) X	3F) . X	0.389	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	П	90.0	MBTU / HR
1165	AREA (SF)	SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.01	MBTU / HR
760 A	AREA (SF)	SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.05	MBTU / HR
۰ ف	AREA (SF)	SF) X	. 0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFÉRENCE	ñ	0.00	MBTU / HR
1344 P	AREA (SF)	SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.04	MBTU / HR
0	AREA (SF)	SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	П	0.00	MBTU / HR
0	AREA (SF)	SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
0	AREA (SF)	SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
25 /	AREA (SF) · X	3F) · X	0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE. DIFFERENCE	п	0.00	MBTU / HR
							l		1

MBTU / HR MJ/HR

0.34 355.37

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 3 OF 3

ECO - 1	%06	-	55	3396	0.34	\$6.60	\$4.62	\$10.84
BASELINE	%09	-	09	4616	0.37	\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES (MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MBTU -PPG

BUILDING NUMBER	6117
	GLOSSARY OF TERMS
1 MBTU = 1055 MJ	
0.019=CONSTANT	
.81 = CONSTANT FOR SLAB	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIRIC	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FROM	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

A	NNUAL HEA	TING ENERG	3 X C	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	(DEGREE	DA	/ METHO	(Q	
BASELINE =	0.37	MBTU/HR X 4 SYS EFF X	1616 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	4 HRS/DAY	11	1,151.76	MBTU/YR	
•	1,151.76	MBTU/YR	×	CORR FACTOR	<del>-</del>	11		1,151.76	MBTUMR
ECO - 1 =	0.34	MBTU/HR X SYS FFF X	3396	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS FFF X 54 TEMP DIFFERENCE	4 HRS/DAY	 	564.90	MBTU/YR	
-	564.90	MBTU/YR	; ×	CORR FACTOR	· —	H		564.90	MBTU/YR
	ECO - 1	ANNUAL HEATIN	IG EN	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	ON SAVING	ıı ıı		586.86 619,135.94	MBTU/YR MJ/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST				
BASELINE =	1,151.76	MBTU/YR X 6.6	6.6	\$ /MBTU	11	= 7,601.62 \$ /YR	\$ MR	
ECO - 1=	564.90	MBTU/YR X 4.62	4.62	\$ /MBTU	II	= 2,609.84 \$ /YR	\$ MR	
	ECO - 1 ANNI	JAL HEATING E	ENERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 4,991.77 \$ MR	11	4,991.77	\$ NR	

# ECO - 1: INFRARED HEATING CALCULATIONS

		(0	-							PAGE 1	1 OF 3
	BUILDING NUMBER:	6118		ПОT	SUILDING H SUTSIDE DE EMPERATL	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE	60	յ <u> </u>		
	INFILTRATION LOSSES =	-	_ AIR CHGS	×	114900	VOL (CUFT) X	29	F TEMP DIFF X 0.019	11	0.13	MBTU / HR
	FLOOR LOSSES =	350	LINEA	R FE	R FEET OF PERIMETER	IMETER X	29	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069	AREA (SF)	×	0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	n	0.04	MBTU / HR
	FACE BRICK/BLK WALL =		AREA (SF)	×	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
	8" CINDER BLOCK WALL =	2936	- AREA (SF)	×	0.389	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	П	0.07	MBTU / HR
	CORR MTL PNL WALL =	1165	- AREA (SF)	×	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	n	0.01	MBTU / HR
J	CLR SGL PANE WINDOWS =	760	AREA (SF)	×	1.235	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	H	90.0	MBTU / HR
	TINTED DBL PANE WIN'W =		- AREď (SF)	×	0.65	U VALUE (BTU/ HR - SF - F) X	59	' F TEMPERATURE DIFFERENCE	П	0.00	MBTU / HR
	METAL ROLL UP DOORS =	1344	AREA (SF)	<b>×</b>	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	H	0.04	MBTU / HR
Z	- METAL GLAZED O'HEAD DR =		AREA (SF)	<b>'</b> ×	0.214	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
	LG MTL SLIDING DOOR =		- AREA (SF)	<b>'</b> ×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
	METAL PERSONNEL DR=		- AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
<	MTL/ GLAZED PERSONNEL=	25	AREA (SF)	×	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	ii	0.00	MBTU / HR
						TOTAL BASEL	-INE	TOTAL BASELINE HEAT LOSSES	81 11	0.37 388.28	MBTU / HR MJ/HR

	Ē	FT KNOX LIMITED EEAP (GLASS)	•	
	EC(	<b>ECO - 1: INFRARED HEATING CALCULATIONS</b>		
			PAGE 2	OF 3
BUILDING NUMBER:	6118	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	55 F 1 F 54 F	
INFILTRATION LOSSES =	-	AIR CHGS X 114900 VOL (CUFT) X 54 F TEMP DIFF X	$\times$ 0.019 = 0.12 N	MBTU / HR
FLOOR LOSSES =	350	LINEAR FEET OF PERIMETER X 54 F TEMP DIFF X	0.81 = 0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069	) AREA(SF) X 0.105 U VALUE(BTU/ 54 F TEMPERATURE HR-SF-F) X DIFFERENCE	JRE = 0.04	MBTU / HR
FACE BRICK/BLK WALL =	0	TU/ 54 F	RE = 0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA(SF) X 0.389 U VALUE (BTU/ 54 F HR - SF - F) X	RE = 0.06	MBTU / HR
CORR MTL PNL WALL =	1165	AREA(SF) X 0.17 U VALUE (BTU/ 54 F I	RE = 0.01	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X 1.235	= 0.05	ÀBTU/HR
TINTED DBL PANE WIN'W=	0,	AREA(SF) X 0.65 U VALUE(BTU/ 54 F TEMPERATURE HR-SF-F) X 54 'DIFFERENCE	RE = .0.00	MBTU / HR
METAL ROLL UP DOORS =	1344	4 AREA(SF) X 0.56 U VALUE(BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	RE = 0.04	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA(SF) X 0.214 U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	RE = 0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X 0.56 U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	RE = 0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X 0.56 U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	RE = 0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA(SF) X 0.615 U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	00:00	MBTU / HR

MBTU / HR MJ/HR

0.34 355.37

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 3 OF 3

	BASEI INF	FCO - 1	
SYSTEM EFFICIENCY	%09	%06	
OUTSIDE DESIGN TEMP (F)	-		-
HTG TEMP SETPOINT (F)	09	22	
HEATING DEGREE DAYS	4616	3396	
TOTAL HEAT LOSSES	0.37	0 34	
(MBTU/HR)	5.	5	
\$ /MBTU -FUEL OIL	\$6.60	\$6.60	
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62	
\$ /MBTU -PPG	\$10.84	\$10.84	

BUILDING NUMBER 6118	
GLOSSARY OF TERMS	
1 MBTU = 1055 MJ	
0.019=CONSTANT	
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	ECT VS
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	

7	NNUAL HEA	TING ENERG	3Y C	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	GREE D	ΑΥ	METHO	(0	
BASELINE =	0.37	MBTU/HR X	4616	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY	SS/DAY			1	
	9.0	SYS EFF X	59	TEMP DIFFERENCE		11	1,151.76	MBTUYR	
	1,151.76	MBTU/YR	×	CORR FACTOR 1		11.		1,151.76	MBTU/YR
ECO - 1 =	0.34	MBTU / HR X	3396	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY	SS/DAY				
	0.0	SYS EFF X	54	TEMP DIFFERENCE		11	564.90	MBTU/YR	
	564.90	MBTU/YR	×	CORR FACTOR 1		11	·	564.90	MBTU/YR
	ECO - 1	ANNUAL HEATII	NG EI	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	AVINGS	и в		586.86 619,135.94	MBTU/YR MJ/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST				
BASELINE =	1,151.76	MBTU/YR X 6.6	9.9	\$ /MBTU	II	= 7,601.62 \$ /YR	\$ /YR	
ECO - 1 =	564.90	MBTU/YR X 4.62	4.62	\$ /MBTU	и.	2,609.84 \$ MR	\$ MR	
	ECO - 1 ANNI	JAL HEATING E	:NERGY (	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 4,991.77 \$ MR	H	4,991.77	\$ MR	

# **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAGE	PAGE 1 OF 3
BUILDING NUMBER:	6142		BUILDING H OUTSIDE DI TEMPERATI	BUILDING HEATING TEMPERATURE SETPOINT OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE URE		60 F 1 F 59 F		
INFILTRATION LOSSES =	-	_ AIR CHGS X	138900	VOL (CUFT) X	29	F TEMP DIFF X 0.019	11	0.16	MBTU / HR
FLOOR LOSSES =	390	LINEAR	LINEAR FEET OF PERIMETER	RIMETER X	29	F TEMP DIFF X 0.81	.	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	п	0.05	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	н	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	n	0.02	MBTU / HR
CLR SGL 'PANE WINDOWS =	760	AREA (SF) X	1.235	.U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	n	0.06	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	. 0.65	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	ij	0.00	MBTU-/ HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	П	90.0	MBTU / HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
METAL PERSONNEL DR=		– AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR

MBTU / HR MJ/HR

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TOTAL BASELINE HEAT LOSSES

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# **ECO - 1: INFRARED HEATING CALCULATIONS**

2 OF 3		MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	
PAGE 2		0.14	0.02	0.05	0.00	90.0	0.02	0.05	0.00	0.05	0.00	0.00	0.00	0.00	
	ir ir ir	II	11	II	н	Ħ	II	н	11	11	11	H	Н	" ,	1
	RE SETPOINT: 55	F TEMP DIFF X 0.019	F TEMP DIFF X 0.81	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	
	ATURE TURE	54	54 F	54	54	54	54	54	54	54	54	54	54	54	
	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	VOL (CUFT) X	PERIMETER X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/' HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	
	SUILDING SUTSIDE TEMPER/	138900	LINEAR FEET OF P	0.105	0.176	0.389	0.17	1.235	0.65	0.56	0.214	0.56	0.56	0.615	
	шОГ	×	AR FE	×	×	×	×	×	× (:	× (-	× (:	×	× (	× (-	
-		AIR CHGS	LINE	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	ARĖA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	
	6142	<del></del>	390	8100	0	2743	1685	. 092	0	1792	0	0	0	. 20	
	BUILDING NUMBER:	INFILTRATION LOSSES =	FLOOR LOSSES =	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	FACE BRICK/BLK WALL =	8" CINDER BLOCK WALL =	CORR MTL PNL WALL =	CLR SGL PANE WINDOWS =	TINTED DBL PANE WIN'W =	METAL ROLL UP DOORS =	WOOD GLAZED O'HEAD DR =	LG MTL SLIDING DOOR =	METAL PERSONNEL DR=	MTL/ GLAZED PERSONNEL=	

MBTU / HR MJ/HR

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**ECO - 1: INFRARED HEATING CALCULATIONS** 

ECO - 1	%06	<del></del>	22	3396	0.39	\$6.60	\$4.62	\$10 B4
BASELINE	%09	-	09	4616	0.42	\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES (MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	Sqq-UTRW/&

BUILDING NUMBER 6142
GLOSSARY OF TERMS
1 MBTU = 1055 MJ
0.019=CONSTANT
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

1	ANNUAL HEA	TING ENERG	3Y C	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	DAY	METHO	(Q	
BASELINE =	0.42	MBTU/HR X 4 SYS EFF X	1616 59	TU/HR X 4616 DEGREE DAYS X 24 HRS/DAY FFF X 59 TEMP DIFFERENCE	II	1,316.82	MBTUMR	
•	1,316.82	MBTU/YR	×	CORR FACTOR 1	11		1,316.82	MBTUMR
ECO - 1 =	0.39	MBTU/HR X 3 SYS EFF X.	3396 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X. 54 TEMP DIFFERENCE	н	645.86	MBTU/YR	
	645.86	MBTU/YR	×	CORR FACTOR 1	н	,	645.86	MBTUMR
	ECO - 1 ANNU	ANNUAL HEATIN	IG EN	AL HEATING ENERGY CONSUMPTION SAVINGS	11 11		670.96 707,867.19	MBTU/YR MJ/YR

	ANNOAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST			
BASELINE =	1,316.82	1,316.82 MBTU/YR X 6.6	6.6	\$ /MBTU	и	8,691.04 \$ /YR	\$ MR
ECO - 1 =	645.86	MBTU/YR X 4.62	4.62	\$ /MBTU	11	= 2,983.87 \$ /YR	\$ MR
	ECO - 1 ANNI	JAL HEATING E	ENERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS =		5,707.17 \$ MR	\$ MR

### **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAG	PAGE 1 OF 3
BUILDING NUMBER:	6143	# O F	BUILDING H BUTSIDE DE FEMPERATI	BUILDING HEATING TEMPERATURE SETPOINT OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE		60 F 1 F 59 F		
INFILTRATION LOSSES =	-	AIR CHGS X	138900	VOL (CUFT) X	59	F TEMP DIFF X 0.019	     6	0.16	MBTU / HR
FLOOR LOSSES =	390	_ LINEAR FE	LINEAR FEET OF PERIMETER	IMETER X	29	F TEMP DIFF X 0.81	11	0.02	MBTU/HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	п	0.05	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	n	90.0	MBTU/HR
CORR MTL PNL WALL =	1685	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	lì	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	. 760	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE . DIFFERENCE	п	90.0	MBTU / HR
TINTED DBL PANE WIN'W =	; •	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F). X	59	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	ii	0.00	MBTU/HR
		1					1		

MBTU / HR MJ/HR

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	Ш	ECO - 1: INFRA	RED !	INFRARED HEATING CALCULATIONS	CULATIO	NS			
BUILDING NUMBER:	6143		BUILDING DUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT. OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE SETPOII	55		PAGE	2 OF 3
INFILTRATION LOSSES =	<del></del>	AIR CHGS X	138900	VOL (CUFT) X 54	F TEMP DIFF	F X 0.019	#1	0.14	MBTU / HR
FLOOR LOSSES =	390	LINEAR FEET OF		PERIMETER X 54	1 F TEMP DIFF	F X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	AREA (SF) X	0.105	U VALUE (BTU/ 54 HR-SF-F) X	L.	TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ 54 HR-SF-F) X	F.	TEMPERATURE DIFFERENCE	н	00.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X	0.389	U VALUE (BTU/ 54 HR-SF-F) X	L.	TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF) X	0.17	U VALUE (BTU/ 54 HR-SF-F) X	щ	TEMPERATURE DIFFERENCE	п	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	160	AREA (SF) · X	1.235	U VALUE (BTU/ 54 HR-SF-F) X	LL.	TEMPERATURE DIFFERENCE	•11	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	9.65	U VALUE (BTU/ 54 HR-SF-F) X	т_	TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	0.56	U VALUE (BTU/ 54 HR-SF-F) X	т_	TEMPERATURE DIFFERENCE	п	0.05	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X	0.214	U VALUE (BTU/ 54 HR - SF - F) X	щ.	TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ 54 HR-SF-F) X	ш_	TEMPERATURE DIFFERENCE	R	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ 54 HR-SF-F) X	ш_	TEMPERATURE DIFFERENCE	R	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X	0.615	U VALUE (BTU/ 54 HR-SF-F) X 54	щ	TEMPERATURE DIFFERENCE		0.00	MBTU / HR
				TOTAL ECO P	TOTAL ECO HEAT LOSSES		11	0.39	MBTU / HR

ECO - 1: INFRARED HEATING CALCULATIONS

									_
 ECO - 1	%06	τ-	55	3396	0.39		\$6.60	\$4.62	\$10.84
BASELINE	%09	-	09	4616	0.42		\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	(MBIO/HK)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	A MATEL PPG

BUILDING NUMBER 6143	
GLOSSARY OF TERMS	
1 MBTU = 1055 MJ	
0.019=CONSTANT	
81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	M ASHRAE
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	<b>EATING EFFECT VS</b>
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	328.2

	ANNUAL HEA	TING ENERG	iY C	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	REE D'	AY METH	(ac		
BASELINE =	0.42	MBTU / HR X 4 SYS EFF X	1616 59	TU / HR X 4616 DEGREE DAYS X 24 HRS/DAY EFF X 59 TEMP DIFFERENCE	1	= 1,316.82	MBTU/YR		
	1,316.82	MBTU/YR	×	CORR FACTOR 1		11	1,316.82	MBTU/YR	
ECO - 1 =	0.39	MBTU / HR X 3 SYS EFF X	3396 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	1	= 645.86	MBTU/YR		
	645.86	MBTU/YR	×	CORR FACTOR 1		11	645.86	MBTUYR	
	ECO - 1 ANNU	ANNUAL HEATIN	IG EN	AL HEATING ENERGY CONSUMPTION SAVINGS		H 11	670.96 707,867.19	MBTUMR	

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST				
BASELINE =	1,316.82	1,316.82 MBTU/YR X 6.6	9.9	\$ /MBTU	n	= 8,691.04 \$ /YR	\$ MR	
ECO - 1 =	645.86	MBTU/YR X 4.62	4.62	\$ /MBTU	В	= 2,983.87 \$ /YR	\$ /⁄R	
	ECO - 1 ANN	UAL HEATING E	NERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 5,707.17 \$ MR	. 11	5,707.17	\$ MR	

# **ECO - 1: INFRARED HEATING CALCULATIONS**

				. :				PAGE 1	1 OF 3
BUILDING NUMBER:	6144	1	BUILDING H OUTSIDE DI TEMPERATI	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE	SETPOINT: 60	<u> </u>		
INFILTRATION LOSSES =		AIR CHGS X	138900	VOL (CUFT) X	. 69	F TEMP DIFF X 0.019	ti	0.16	MBTU / HR
FLOOR LOSSES=	390	LINEAR	LINEAR FEET OF PERIMETER	IMETER X	59 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES	0100	Y (SE) YE		U VALUE (BTU/	Ċ	F TEMPERATURE		i	
	0010	_	0.100	HR-SF-F) X	e FC		n .	0.05	MBTU/HR
FACE BRICK/BLK WALL =		AREA (SF) X -	0.176	U VALUE (BIU) HR-SF-F) X	29	r IEMPEKATURE DIFFERENCE	. 11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCĘ	n	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	260	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	#1	90.0	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	29	F TËMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	п	90.0	MBTU / HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	В	0.00	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	ŧı	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	<b>1</b> 1	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
							İ		

MBTU / HR MJ/HR

0.42

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#### ECO - 1: INFRARED HEATING CALCULATIONS

									PAGE	PAGE 2 OF 3
BUILDING NUMBER:	6144			BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	XTUT II	JRE SETPOINT: 55 F (E 1 F 54 F	<u>ш</u> и, ш		
INFILTRATION LOSSES =	-	AIR CHGS	×	138900	VOL (CUFT) X 54 F TEMP DIFF	54	F TEMP DIFF X 0.019	11	0.14	MBTU / HR
FLOOR LOSSES =	390	LINEAF	? FE	ET OF PE	LINEAR FEET OF PERIMETER X	54	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES										
FLAT BUILT UP ROOF =	8100	AREA (SF)	×	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	#1	0.05	MBTU/HR
FACE BRICK/BLK WALL =	0	AREA (SF)	×	0.176	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF)	×	0.389	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	• 11	90.0	MBTU/HR
CORR MTL PNL WALL =	1685	AREA (SF)	×	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	260	AREA (SF)	×	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU/HR
TINTED DBL PANE WIN'W =	0	AREA (SF)	×	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
METAL ROLL UP DOORS =	1792	AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	ti.	0.05	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF)	×	0.214	U VALUE (BTU/ HR - SF - F) X	. 24	F TEMPERATURE DIFFERENCE	п	0.00	MBTU/HR
LG MTL SLIDING DOOR =	0	AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	• 11	0.00	MBTU/HR
METAL PERSONNEL DR=	0	AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	Ħ	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X	×	0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
								l		

MBTU / HR MJ/HR

0.39

TOTAL ECO HEAT LOSSES

**ECO - 1: INFRARED HEATING CALCULATIONS** 

SYSTEM EFFICIENCY
OUTSIDE DESIGN TEMP (F)
HTG TEMP SETPOINT (F)
HEATING DEGREE DAYS
TOTAL HEAT LOSSES
\$ /MBTU -NATURAL GAS

NUMBER 0144	GLOSSARY OF TERMS	55 MJ	0.019=CONSTANT .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2
BUILDING NUMBER		1 MBTU = 1055 MJ	0.019=CONSTANT 81 = CONSTANT FOR SI CORR FACTOR = EMPI 65 F DEGREE-DAYS FR

	ANNUAL HEATING	ATING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	DAY METHC	(0)	
BASELINE =	0.42	MBTU/HR X 4616 SYS EFF X 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	= 1,316.82	MBTU/YR	
	1,316.82	MBTU/YR X	CORR FACTOR 1	. 11	1,316.82	MBTU/YR
ECO - 1 =	0.39	MBTU/HR X 3396 SYSEFF X 54	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	. = 645.86	MBTU/YR	
	645.86	MBTU/YR X	CORR FACTOR 1	II	645.86	MBTU/YR
	ECO - 1	ANNUAL HEATING E	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	n u	670.96 707,867.19	MBTUMR

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST			
BASELINE =	1,316.82	1,316.82 MBTU/YR X 6.6	9.9	\$ /MBTU	н	= 8,691.04 \$ /YR	\$ MR
ECO - 1 =	645.86	MBTU/YR X 4.62	4.62	\$ /MBTU	H	2,983.87 \$ MR	\$ MR
	FCO - 1 ANNI	UAL HEATING E	ENERGY	FCO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 5,707.17 \$ MR	11	5,707.17	\$ MR

# **ECO - 1: INFRARED HEATING CALCULATIONS**

J		-						-	PAGE	PAGE 1 OF 3
	BUILDING NUMBER:	6145		BUILDING H OUTSIDE DE TEMPERATU	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE URE	SETPOINT: 60	и п п		
	INFILTRATION LOSSES =	-	AIR CHGS	X 138900	VOL (CUFT) X	29	F TEMP DIFF X 0.019	11	0.16	MBTU / HR
	FLOOR LOSSES =	390	_ LINEAR	LINEAR FEET OF PERIMETER	IMETER X	29	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	8100 AREA (SF)	X 0.105	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	u	0.05	MBTU / HR
	FACE BRICK/BLK WALL =		AREA (SF)	X 0.176	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
	8" CINDER BLOCK WALL =	2743	AREA (SF)	X 0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
	CORR MTL PNL WALL =	1685	AREA (SF)	X 0.17	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	H	0.02	MBTU / HR
	CLR SGL PANE WINDOWS =	760	AREA (SF)	X 1.235	U VAĽÚE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
	TINTED DBL PANE WIN'W =	•	AREA (SF)	X 0.65	U VALUE (BTU/ HR - SF - F) X	. 69	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
	METAL ROLL UP DOORS =	1792	AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
_	METAL GLAZED O'HEAD DR =		AREA (SF)	X 0.214	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
	LG MTL SLIDING DOOR =		AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
	METAL PERSONNEL DR=		AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
	MTL/ GLAZED PERSONNEL=	50	AREA (SF)	X 0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
	1		1					1		

MBTU / HR MJ/HR

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

			: ·.				<u>.</u>	PAGE 2 OF	2 OF 3
BUILDING NUMBER:	6145	<b>M</b> O <b>F</b>	UILDING H UTSIDE D EMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUR TURE	E SETPOINT: 55	յ <u> </u>		
INFILTRATION LOSSES =	-	AIR CHGS X	138900	VOL (CUFT) X 54 F TEMP DIFF	54 F	TEMP DIFF X 0.019	11	0.14	MBTU / HR
FLOOR LOSSES =	390	LINEAR FEET OF PERIMETER	T OF PE	RIMETER X	54 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	8100 - AREA(SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	24	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.05	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
MTt/ GLAZED PERSONNEL=	20	AREA:(SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II.	0.00	MBTU / HR
				TOTAL ECO HEAT LOSSES	HEA	TLOSSES	11 11	0.39	MBTU / HR

MBTU / HR MJ/HR

0.39 406.30

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### **ECO - 1: INFRARED HEATING CALCULATIONS**

ECO - 1	%06	-	55	3396	0.39	\$6.60	\$4.62	\$10.84
BASELINE	%09	-	09	4616	0.42	\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MRTI! -PPG

BUILDING NUMBER	6145	1
	GLOSSARY OF TERMS	
1 MBTU = 1055 MJ		
0.019=CONSTANT		
.81 = CONSTANT FOR SLAE	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	
CORR FACTOR = EMPIRIC	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	
65 F DEGREE-DAYS FROM	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	

	ANNUAL HEATIN	TING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	<b>DAY МЕТНО</b>	(Q	
BASELINE =	0.42	MBTU/HR X 4616 SYS EFF X 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	= 1,316.82	MBTU/YR	
	1,316.82	MBTU/YR X	CORR FACTOR 1	п	1,316.82	MBTU/YR
ECO - 1 =	0.39	MBTU/HR X 3396 SYS EFF X 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	= 645.86	MBTU/YR	
	645.86	MBTU/YR X	X CORR FACTOR 1	11	645.86	MBTU/YR
	ECO - 1	ANNUAL HEATING E	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	11 11	670.96 707.867.19	MBTU/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST				
BASELINE =	1,316.82	MBTU/YR X 6.6	6.6	\$ /MBTU	II	= 8,691.04 \$ /YR	\$ /YR	
ECO - 1=	645.86	MBTU/YR X 4.62	4.62	\$ /MBTU	Ħ	2,983.87 \$ /YR	_\$ /YR	
	ECO - 1 ANNI	JAL HEATING E	NERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 5.707.17 \$ //R	II	5,707.17	\$ MR	

BUILDING NUMBER: 6146  INFILTRATION LOSSES = 1 AIR CHGS FLOOR LOSSES = 390 LINEA SURFACE HEAT LOSSES FLAT BUILT UP ROOF = 8100 AREA (SF)	ECO - 1: INFI	RARED H	INFRARED HEATING CALCILI ATIONS	2	OINCITA II			
11 11 11	AIR CHGS X			ׅ֡֝֝֝֟֝֝֟֝֝֟֝֝֟֝֟֝֝֟֝֓֓֓֓֓֓֓֓֓֡֩	LATIONS			
II II II	AIR CHGS X					-	PAGE 1	1 OF 3
	AIR CHGS X	BUILDING H OUTSIDE DE TEMPERATU	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	URE	SETPOINT: 60	_ 		
ιι <sub>11</sub>	LINEAR	138900	VOL (CU FT) X	59	F TEMP DIFF X 0.019	"	0.16	MBTU / HR
ii		LINEAR FEET OF PERIMETER	IMETER X	59	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
			II VALUE (BTU)		F TEMPERATURE			
	KEA (SF) X	0.105	HR - SF - F) X	29		11	0.05	MBTU / HR
FACE BRICK/BLK WALL = A	AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL = 2743 A	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	#	90.0	MBTU / HR
CORR MTL PNL WALL = 1685 A	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.02	MBTU / HR
CLR SGL PANE WINDOWS = 760 A	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
TINTED DBL PANE WIN'W = · · A	AREA (SF) X	. 0.65	U VALUE (BTU/ HR - SF - F) X	. 69	F TEMPERATURE . DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS = 1792 A	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
METAL GLAZED O'HEAD DR =A	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR = A	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL PERSONNEL DR= A	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL= 50 A	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR

MBTU / HR MJ/HR

0.42

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### **ECO - 1: INFRARED HEATING CALCULATIONS**

						·	PAGE 2 OF	2 OF 3
BUILDING NUMBER:	6146	BUII OUT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	RATUR VTURE	RE SETPOINT: 55 F			
INFILTRATION LOSSES =	<del>-</del>	AIR CHGS X 130	138900 VOL (CUFT) X 54 F TEMP DIFF	54 F	TEMP DIFF X 0.019	"	0.14	MBTU / HR
FLOOR LOSSES =	390	LINEAR FEET	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	AREA (SF) X	0.105 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.05	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X 0.	0.176 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X 0.	0.389 U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	ij	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF) X 0	0.17 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.02	MBTU / HR
CLR SGL PÁNE WINDOWS =	760	AREA (SF) X 1.	1.235 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	0.05	.MBTU/HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X 0	0.65 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	. 11	0.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X 0	0.56 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X 0	0.214 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X 0	0.56 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	n	0.00	MBTU/HR
METAL PERSONNEL DR=	0	AREA (SF) X 0	0.56 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	00.00	MBTU/HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X 0.	0.615 U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
						1		1

MBTU / HR MJ/HR

0.39 406.30

11 11

TOTAL ECO HEAT LOSSES

### **ECO - 1: INFRARED HEATING CALCULATIONS**

	BASELINE	ECO - 1
SYSTEM EFFICIENCY	%09	%06
OUTSIDE DESIGN TEMP (F)	<b>-</b>	<del>-</del>
HTG TEMP SETPOINT (F)	09	22
HEATING DEGREE DAYS	4616	3396
TOTAL HEAT LOSSES (MBTU / HR)	0.42	0.39
\$ /MBTU -FUEL OIL	\$6.60	\$6.60
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62
\$ /MBTU -PPG	\$10.84	\$10.84

BUILDING NOMBER 6146
GLOSSARY OF TERMS
1 MBTU = 1055 MJ
0.019=CONSTANT
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

A	INNUAL HEA	TING ENERGY	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	EGREE D	AY	METHOL	(6	
BASELINE =	0.42	MBTU/HR X 4616 SYS EFF X 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	HRS/DAY	11	1,316.82	MBTUNR	
	1,316.82	. MBTU/YR X	CORR FACTOR 1	•	11		1,316.82	MBTU/YR
ECO - 1 =	0.39	MBTU/HR X 3396 SYS EFF X 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	HRS/DAY	n	645.86	MBTU/YR	
	645.86	MBTU/YR X	CORR FACTOR 1		п	'	645.86	MBTU/YR
	ECO - 1	ANNUAL HEATING	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	SAVINGS	11 11		670.96 707,867.19	MBTU/YR MJ/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST			
BASELINE =	1,316.82	MBTU/YR X 6.6	9.9	\$ /MBTU	В	= 8,691.04 \$ MR	\$ MR
ECO - 1 =	645.86	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,983.87 \$ MR	\$ MR
	ECO. 1 ANNI	IAI HEATINGE	NFRGY .	ECO 1 ANNIAL HEATING ENERGY COST SAVINGS = 5707.17 \$ /YR	ji	5.707.17	S VR

	1	T KNOX	LIMIT	FT KNOX LIMITED EEAP (GLASS)	9)	LASS)		•	
	Щ	30 - 1: INFR	AREDI	ECO - 1: INFRARED HEATING CALCULATIONS	rcr	JLATIONS			
								PAGE 1 OF	1 OF 3
BUILDING NUMBER:	6147		BUILDING FOUTSIDE D	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE	60	ir ir ir		
INFILTRATION LOSSES =	-	AIR CHGS X	138900	VOL (CUFT) X	59	F TEMP DIFF X 0.019	11	0.16	MBTU / HR
FLOOR LOSSES=_	390	_ LINEAR FE	LINEAR FEET OF PERIMETER	RIMETER X	59	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES						·			
FLAT BUILT UP ROOF =	8100	AREA (SF) X	0.105	U VALUE (BIU/ HR-SF-F) X	29	r lemperalure Difference	11	0.05	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	н	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	n	90:0	MBTU / HR
TINTED DBL PANE WIN'W =		_ AREA (SF) X	0.65	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	. 00:0	MBTU/HR
METAL ROLL UP DOORS =	1792	AREA(SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	H	90.0	MBTU/HR
METAL GLAZED O'HEAD DR =		AREA (SF) X	0.214	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HŔ
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
MTL/ GLAZED PERSONNEL=	50	AREA(SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
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MBTU / HR MJ/HR

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### **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 2 OF 3		_MBTU/HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR
PAGE		0.14	0.02	0.05	00.00	90.0	0.02	0.05	00.00	0.05	00.00	00.00	00.00	00.00
	55 F 1 F 54 F	11	11	n	11	11	П	II	Ħ	n	Ħ	n	11	II
		F TEMP DIFF X 0.019	F TEMP DIFF X 0.81	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE
	ATUR TURE	54 F	54 F	54	54	54	54	54	54	54	54	54	54	54
	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	VOL (CUFT) X	PERIMETER X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ . HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR-SF-F) X
• .	SUILDING SUTSIDE TEMPER	138900	LINEAR FEET OF F	0.105	0.176	0.389	0.17	1.235	0.65	0.56	0.214	0.56	0.56	0.615
	шОР	×	R FEI	×	×	×	×	×	×	×	×	×	×	×
. '		AIR CHGS	LINEA	8100 AREA(SF) X	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	· AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF) X
	6147	-	390	8100	0	2743	1685	760	0	1792	0	0	0	20
	BUILDING NUMBER:	INFILTRATION LOSSES =	FLOOR LOSSES =	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	FACE BRICK/BLK WALL =	8" CINDER BLOCK WALL =	CORR MTL PNL WALL =	CLR SGL PANE WINDOWS =	TINTED DBL PANE WIN'W =	METAL ROLL UP DOORS =	WOOD GLAZED O'HEAD DR =	LG MTL SLIDING DOOR =	METAL PERSONNEL DR=	MTL/ GLAZED PERSONNEL=

MBTU / HR MJ/HR

11 11

TOTAL ECO HEAT LOSSES

### **ECO - 1: INFRARED HEATING CALCULATIONS**

ECO - 1	%06	-	55	3396	0.39	\$6.60	\$4.62	\$10.84
BASELINE	%09	<b>Y-</b>	09	4616	0.42	\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES (MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MBTU -PPG

	ANNUAL HEATING	TING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	DEGREE C	AYI	METHOD			
BASELINE =	0.42	MBTU/HR X 4616	MBTU/HR X 4616 DEGREE DAYS X 24 HRS/DAY	HRS/DAY		( )			
	9.0	SYSELL X 59	LEMP UIPPEKENCE		11	1,316.82	MB10/YK		
	1,316.82	MBTUMR X	CORR FACTOR	<b>-</b> -	<b>1</b> 1		1,316.82	MBTU/YR	
ECO - 1 =	0.39	MBTU / HR X 3396	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY	HRS/DAY					
	6.0	SYS EFF X . 54	TEMP DIFFERENCE		11	645.86 .	MBTUNR		
	645.86	MBTU/YR X	CORR FACTOR	-	II	l	645.86	MBTU/YR	
	ECO - 1	ANNUAL HEATING E	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	ON SAVINGS	11 11	•	670.96 707,867.19	MBTU/YR MJ/YR	

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST				
BASELINE =	1,316.82	MBTU/YR X 6.6	9.9	\$ /MBTU	II	= 8,691.04 \$ MR	\$ MR	
ECO - 1 =	645.86	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,983.87 \$ MR	_\$ MR	
	ECO - 1 ANNI	JAL HEATING E	NERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 5.707.17 \$ //R	Į1	5.707.17	\$ /YR	

STUDY: 6560ECO1 LCCID 1.080 LIFE CYCLE COST ANALYSIS SUMMARY ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID : INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: 6560ECO1 ECO-1 INFRARED HEAT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED

10-18-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH ANALYSIS DATE:

- 1. INVESTMENT
- A. CONSTRUCTION COST \$ 239399.
  B. SIOH \$ 11970.
  C. DESIGN COST \$ 11970.
  D. TOTAL COST (1A+1B+1C) \$ 263339.

- F. PUBLIC UTILITY COMPANY REBATE \$
  G. TOTAL INVESTMENT (1D 1E 1F) 0. 0.
- 263339.
- 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED FUEL \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) 

   0.
   \$ 0.
   15.61 \$ 0.

   6569.
   \$ 43357.
   17.56 \$ 761356.

   0.
   \$ 0.
   19.97 \$ 0.

   -3222.
   \$ -14886.
   20.96 \$ -312006.

   0.
   \$ 0.
   17.58 \$ 0.

   0.
   \$ 0.
   16.12 \$ 0.

   \$ 0.
   \$ 14.74 \$ 0.

   3347.
   \$ 28472.
   \$ 449350.

   A. ELECT \$ .00
  B. DIST \$ 6.60
  C. RESID \$ .00
  D. NAT G \$ 4.62
  E. COAL \$ .00
  F. LPG \$ .00
- 3. NON ENERGY SAVINGS (+) / COST(-)

M. DEMAND SAVINGS

N. TOTAL

- 2970. A. ANNUAL RECURRING (+/-) (1) DISCOUNT FACTOR (TABLE A)
  - (1) DISCOUNT FACTOR (TABLE A) 14.74 (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 43778.
- B. NON RECURRING SAVINGS(+) / COSTS(-)

		SAVINGS(+)	YR	DISCNT	DISCOUNTED
•	ITEM	COST(-)	OC (2)	FACTR (3)	SAVINGS(+)/ COST(-)(4)
1.	REPAIR	\$ 19073.	5	.86	16402.
2.	REPAIR2 REPAIR3	\$ 19073. \$ 2727.	15 7	.63 .81	12016. 2209.
4.	REPAIR4	\$ 2727.	14	.65	1773.
5.	ENVIR	\$ 64738.	3	.91	58912.
đ.	TOTAL	\$ 108338.			91312.

- C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 135089.
- 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 36858.
- 7.14 YEARS 5. SIMPLE PAYBACK PERIOD (1G/4)
- \$ 584439. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C)
- 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 2.22 (IF < 1 PROJECT DOES NOT QUALIFY)
- 7.29 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

14-Oct-94 65XX AREA Date: COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: City indx:Louisville, KY MAIN GAS LINE Sq. footage: Description Line # Equipment Matl Labor Manhours SITE DEMOLITION, PAVEMENT, CONCRETE, TO 0205542200 111.00 C.Y. 24 "THICK, REINFORCED 226.16 92.52 133.64 0.00 0.00 Unit values 4.21 \$0 \$0 \$10,270 \$14,834 \$25,104 Totals 467.42 TAMPING TRENCH B'FILL, VIBRATING PLATE, ADD 0222541900 111.00 C.Y. 0.67 2.41 0.00 1.74 0.00 Unit values 0.09 \$74 \$267 Totals 9.88 \$0 \$193 \$0 TRENCH EXCVTNG 40HP CHNTRNCHR&BKFL 12"W24"D 0222582800 1500.00 L.F. 0.00 0.24 0.00 0.24 0.47 Unit values 0.01 \$0 \$0 \$355 \$355 \$710 15.00 Totals CONCRETE PAVING, JOINTS/FINISH, 4500 PSI 0251200400 CONCRETE, 12" THICK 167.00 S.Y. 17.52 1.07 1.02 0.00 19.61 0.05 Unit values \$170 \$0 8.18 \$2,926 \$179 \$3,275 Totals BEDDING, FOR PIPE IN TRENCH SAND, DEAD OR 0260120200 28.00 C.Y. BANK 2.43 3.37 1.37 0.00 7.17 0.16 Unit values \$68 \$94 \$38 \$0 \$200 4.48 Totals BEDDING, PLACING IN TRENCH 0260120500 28.00 C.Y. Unit values 0.09 0.00 1.74 0.67 0.00 2.41 \$19 \$0 Totals 2.49 \$0 \$49 \$68 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 35.47 5.91 300.98 Unit values 259.60 0.00 1.56 \$0 \$301 \$35 \$6 1.56 \$260 Totals GAS SERVICE & DISTRIB PIPING, POLYETHYLENE, 60-0268520200 PSI 2" DIAM COIL SDR 11 1500.00 L.F. 2.23 Unit values 0.07 0.75 1.48 0.00 0.00 \$0 \$0 Totals 100.50 \$1,129 \$2,220 \$3,349

Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
U02 SITEWORK	610	\$4,383	\$13,395	\$15,496	\$,0	\$33,274		
1562600139	GAS APPLIA	NCE REGUI	LATORS DOL	JBLE DIAPHRA	GM			
1362600137		PE SIZE			1.00	Ea.		
Unit values	0.73	420.00	16.42	0.00	0.00	436.42		
Totals	0.73	\$420	\$16	. \$0	\$0	\$436		
U15 MECHANICAL	1	\$420	\$16	\$0	\$0	\$436		

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Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	=======						
ESTIMATE TOTAL	611	\$4,803	\$13,411	\$15,496	\$0	\$33,710	
SALES TAX	0.00% 0.00%	\$0 \$0					
MATL MARKUP LABOR MARKUP	0.00%	Ų O	\$0				
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0		
TOTAL BEFORE C	ONTINGENC	\$4,803	\$13,411	\$15,496	\$0	\$33,710	
CONTINGENCY	10.00%					\$3,371 \$0	
BOND PROFIT	10.00%					\$3,371	
JOB TOTAL					•	\$40.452	

Estimate:

65XX AREA

Date: 14-Oct-94

Description:

COST ESTIMATE

Project:

LIMITED EEAP(GLASSBid Date:

94013.02

JOB TOTAL

City indx:Louisville, KY

Location: FORT KNOX, KY Job #: Sq. footage: MAIN GAS LINE City indx SUMMARY \_\_\_\_\_\_ Matl Labor Equipment Sub Total Manhours \$4,383 \$13,395 \$15,496 \$0 610 \$33,274 U02 SITEWORK \$420 \$16 \$0 \$0 \$436 U15 MECHANICAL 1 \$4,803 \$13,411 \$15,496 \$0 \$33,710 611 TOTAL \$0 SALES TAX 0.00% \$0 MATL MARKUP 0.00% \$0 0.00% LABOR MARKUP \$0 EQUIPT MARKUP 0.00% \$0 0.00% SUB MARKUP \$4,803 \$13,411 \$15,496 \$0 \$33,710 TOTAL BEFORE CONTINGENC \$3,371 CONTINGENCY 10.00% 0.00% \$0 BOND \$3,371 PROFIT 10.00% \$40,452

Estimate: BLDG 6560 14-Oct-94 Date: COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY 94013.02 Job #: Location: City indx:Louisville, KY 4800.00 Sq. footage: Description Labor Equipment Matl Manhours \_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 400.00 L.F. 4"DIAMETER 3.16 1.29 0.00 0.00 Unit values 0.15 \$0 \$514 \$0 \$1,776 60.00 \$1,262 Totals HVAC DEMO, MECH EOPT HEAVY ITEM 0207183600 0.50 Ton 380.36 0.00 380.36 0.00 14.55 0.00 Unit values \$190 \$0 \$0 \$190 7.27 \$0 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 200.00 L.F. 1.97 0.24 0.00 0.00 2.21 Unit values 0.07 \$395 \$47 \$0 \$442 14.20 \$0 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 100.00 Ea. DIAMETER PIPE 0.00 5.55 0.68 6.23 0.20 0.00 Unit values \$555 \$68 \$0 \$623 20.00 \$0 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 5.91 0.00 300.98 259.60 35.47 Unit values 1.56 \$6 \$0 Totals 1.56 \$260 \$35 \$301 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 1.92 2.96 5.06 Unit values 0.11 0.17 0.00 \$96 \$148 \$9 \$0 Totals 5.35 \$253 U02 SITEWORK 109 \$356 \$2,585 \$644 \$0 \$3,585

	========	=======				
Line #	Description	l				
	Manhours	Matl	Labor E	Equipment	Sub	Total
	=======================================	:======:	=======			
1554510245	HTG INFA-RI	UNT GAS	ELEC IGN	(See Atta	ached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00	0.00 \$0	18822.00 \$18,822	18822.00 \$18,822
1562600137	GAS APPLIAN TYPE 1-1/4"			BLE DIAPHRA	AGM 1.00	Ea.
Unit values Totals	0.53		12.10 \$12	0.00	0.00	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$18,822	\$19,060

_ ====================================							
Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	========					=======	
ESTIMATE TOTAL	110	\$582	\$2,597	\$644	\$18,822	\$22,645	
SALES TAX MATL MARKUP	0.00%	\$0 \$0					
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	\$0	\$0		
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,597	\$644	\$18,822	\$22,645 \$2,265 \$0 \$2,265	
JOB TOTAL	10.00%					\$2,265	

\$27,174

Estimate: BLDG 6560

Date: 14-Oct-94

Description: Project:

COST ESTIMATE

LIMITED EEAP (GLASSBid Date:

FORT KNOX, KY Job #:

94013.02

Location:

JOB TOTAL

City indx:Louisville, KY

Sq. footage: 4800.00 SUMMARY Matl Equipment Sub Labor Manhours \$2,585 \$644 \$0 109 \$356 \$3,585 U02 SITEWORK \$226 \$12 \$0 \$18,822 \$19,060 U15 MECHANICAL 1 \$582 \$2,597 \$644 \$18,822 \$22,645 TOTAL 110 SALES TAX \$0 0.00% \$0 MATL MARKUP 0.00% \$0 LABOR MARKUP 0.00% \$0 EQUIPT MARKUP 0.00% \$0 SUB MARKUP 0.00% \$644 TOTAL BEFORE CONTINGENC \$582 \$2,597 \$18,822 \$22,645 CONTINGENCY 10.00% \$2,265 BOND 0.00% \$0 \$2,265 PROFIT 10.00%

\_\_\_\_\_\_\_ BLDG 6560 Date: 14-Oct-94 Estimate: INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description \_\_\_\_\_ Manhours Matl Labor Equipment \_\_\_\_\_\_ 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 300.00 L.F. 2.22 Unit values 4.57 0.15 0.00 0.00 6.79 Totals 44.70 \$665 \$1,372 \$0 \$0 \$2,037 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES 50.00 L.F. 2.22 Unit values 0.15 4.57 0.00 0.00 6.79 \$0 Totals 7.45 \$111 \$229 \$0 \$340 A09 ELECTRICAL \$776 \$0 53 \$1,601 \$0 \$2,377

=======================================					******	
Line #	Descripti	on				
	Manhours			Equipment	Sub	Total
=======================================		=======				
1517010650	W/CPLGS			CHEDULE 40,	275.00	L.F.
Unit values Totals	0.44	4.17 \$1,147	\$2,833	0.00 \$0		14.47 \$3,980
1517011310		CE PIPE STI	EEL GALV	SCH 40 THRE	W/CPLG 8	
Unit values Totals	0.13 41.91	1.64	2.88 \$949	0.00 \$0	0.00 \$0	4.52 \$1,490
1519010320	ALUMINUM	REFLECTORS	W/HANGE	RS	38.00	Fa
Unit values Totals	0.50 19.00		3.80 \$145	0.00	0.00	43.59 \$1,657
1524105040	VACUUM PU	MP AND VEN	r PIPING		1.00	Fa
Unit values Totals	3.00	738.35 \$738		0.00 \$0	0.00	858.50
1552301020					MBUSTION 6.00	CHAMBER
Unit values Totals	1.00	860.00 \$5,160	44.06 \$264	0.00	0.00	904.06 \$5,424
1554510220	CO-RAY-VA	C VANTAGE	2 INFA-RI	HTG UNIT,	GAS 40 MI 2.00	
Unit values Totals	4.00 8.00	935.00 \$1,870	81.70 \$163	0.00 \$0	0.00	1016.70 \$2,033
1556800120	CO-RAY-VA	C VANTAGE	VENT PI	PE	2.00	Ψa
Unit values Totals	1.60	70.00 \$140	76.50 \$153	0.00 \$0	0.00	146.50 \$293
1574205220	ELECTRIC :	THERMOSTAT	W/ COVER	R AND WIRING	3.00	77-
Unit values Totals	1.00	75.00 \$225	27.55 \$83	. 0.00 \$0	0.00	102.55 \$308
U15 MECHANICAL	207	\$11,333	\$4,710	\$0	\$0	\$16,043

=======================================	========	========						
Line #	Description							
	Manhours	Matl	Labor . Equ	uipment	Sub	Total		
=======================================								
1631200100	HEATING S	YSTEM POWE	R / CONTROL	PANEL	1 00	De		
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00	1.00 0.00 \$0	401.34 \$402		
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402		

		========				
Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
ESTIMATE TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0		
SUB MARKUP	0.00%			<b>4</b> 0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$'0	\$18,822 \$0 \$0 \$0
JOB TOTAL				•		\$18,822

Estimate:

Date: 14-Oct-94 BLDG 6560 Description: INFRARED HEATING SYSTEM COST ESTIMATE Project: LIMITED EEAP(GLASSBID Date: FORT KNOX, KY Job #: 94013.02

Location: Sq. footage:

City indx:Louisville, KY

Sq. Iootage:						
=======================================	======= S	UMMARY	======			
	Manhours	Matl	Labor	Equipment	Sub	Total
==========			=======			
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	207	\$776 \$11,333 \$331	\$1,601 \$4,710 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$16,043 \$402
TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0		
SUB MARKUP	0.00%	•			\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0
JOB TOTAL					•	\$18,822

BLDG 6561 Date: Estimate: 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: City indx:Louisville, KY Sq. footage: 4800.00 \_\_\_\_\_\_\_ Description Line # \_ \_ \_ \_ \_ \_ \_ \_ \_ - - - - - -Equipment Matl Labor Manhours \_\_\_\_\_\_ 0205543200 SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 4"DIAMETER 400.00 L.F. 0.00 Unit values 0.15 3.16 1.29 0.00 4.44 \$1,262 Totals 60.00 \$0 \$514 \$0 \$1,776 0207180380 HVAC DEMO, BOILER GAS/OIL STL >150MBH 1.00 Ea. Unit values 0.00 323.82 0.00 12.00 0.00 323.82 Totals \$0 12.00 \$0 \$324 \$0 \$324 0207183600 HVAC DEMO, MECH EQPT HEAVY ITEM 0.50 Ton 380.36 0.00 Unit values 14.55 0.00 0.00 380.36 Totals 7.27 \$0 \$190 \$0 \$0 \$190 0208400600 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 200.00 L.F. 0.07 0.00 1.97 0.24 Unit values 0.00 2.21 \$0 \$395 \$47 Totals 14.20 \$0 \$442 0208401000 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" DIAMETER PIPE 100.00 Ea. 5.55 Unit values 0.20 0.00 0.68 0.00 6.23 Totals 20.00 \$0 \$555 \$68 \$0 \$623 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. Unit values 259.60 35.47 5.91 1.56 300.98 0.00 Totals 1.56 \$0 \$260 \$6 \$35 \$301 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. 1.92 2.96 Unit values 0.11 0.17 0.00 5.06 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 121 \$356 \$2,909 \$644 \$0 \$3,909

		=======	=======	========	========	========
Line #	Description	n				
,	Manhours	Matl	Labor	Equipment	Sub	Total
1554510245	HTG INFA-R	D UNT GAS	ELEC IG	N (See Att	ached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00	18822.00	18822.00 \$18,822
1562600137	GAS APPLIA			UBLE DIAPHE		<b>7</b> -
Unit values Totals	TYPE 1-1/4 0.53 0.53	226.00 \$226	12.10 \$12	0.00 \$0	1.00 0.00 \$0	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$18,822	\$19,060

=======================================						========
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======================================		•			
ESTIMATE TOTAL	122	\$582	\$2,921	\$644	\$18,822	\$22,969
SALES TAX MATL MARKUP	0.00%	\$0 \$0				
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	\$0	\$0	
	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,921	\$644	\$18,822	\$22,969 \$2,297 \$0 \$2,297
JOB TOTAL						\$27,563

\_\_\_\_\_\_

Estimate: BLDG 6561
Description: COST ESTIMATE

Date: 14-Oct-94

Page 4

Project:

LIMITED EEAP(GLASSBid Date:

Location: Sq. footage: 4800.00

FORT KNOX, KY Job #: 94013.02 4800.00 City indx:Louisville, KY

SUMMARY							
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	========	=======	=======	=======		========	
U02 SITEWORK U15 MECHANICAL	121	\$356 \$226	\$2,909 \$12	\$644 \$0	\$0 \$18,822	\$3,909 \$19,060	
TOTAL	122	\$582	\$2,921	\$644	\$18,822	\$22,969	
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0				
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0		
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,921	· \$644	\$18,822	\$22,969 \$2,297 \$0 \$2,297	
JOB TOTAL						\$27,563	

A09 ELECTRICAL 53

Estimate: BLDG 6561 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date: Project: Location: FORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY Sq. footage: Description \_ Manhours Matl Labor Equipment 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 300.00 L.F. 4.57 Unit values 0.15 2.22 0.00 0.00 6.79 Totals 44.70 \$1,372 \$2,037 \$665 \$0 \$0 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES 50.00 L.F. 0913100200 0.15 2.22 4.57 0.00 Unit values 0.00 6.79 Totals 7.45 \$111 \$229 \$0 \$0 \$340

\$776 \$1,601

\$0

\$0

\$2,377

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Line #	Description					
	Manhours			Equipment		Total
=============	========		======			
1517010650	4				, THREADED 275.00	L.F.
Unit values Totals	W/CPLGS 0.44 122.10	4.17 \$1,147	10.30 \$2,833	0.00 \$0		14.47 \$3,980
1517011310	GAS SERVIO	CE PIPE ST			RD W/CPLG 330.00	
Unit values Totals		1.64 \$541	2.88 \$949	0.00 \$0	0.00	4.52 \$1,490
1519010320	ALUMINUM I	REFLECTORS	W/HANGE	RS	38.00	Ro
Unit values Totals	0.50 19.00	39.79 \$1,512	3.80 \$145	0.00 \$0	0.00	
1524105040	VACUUM PUN	MP AND VEN	T PIPING		1.00	Po
Unit values Totals	3.00 3.00	738.35 \$738	120.15 \$120		0.00	858.50
1552301020	CRV-100 G	AS FIRED B	URNER, 1	. MBH 00	COMBUSTION 6.00	
Unit values Totals	1.00 6.00	860.00 \$5,160	44.06 \$264	0.00 \$0	0.00	
1554510220	CO-RAY-VAC	C VANTAGE	2 INFA-R	D HTG UNIT	, GAS 40 M	
Unit values Totals		935.00 \$1,870			0.00	1016.70 \$2,033
1556800120	CO-RAY-VAC	C VANTAGE :	VENT P	IPE	2.00	E-a
Unit values Totals	1.60 3.20	70.00 \$140	76.50 \$153	0.00 \$0	0.00	146.50
1574205220	ELECTRIC 7	THERMOSTAT	W/ COVE	R AND WIRE		<b>D</b> -
Unit values Totals	1.00	75.00 \$225	27.55. \$83	0.00		102.55 \$308
U15 MECHANICAL	207	\$11,333	\$4,710	. \$0	\$0	\$16,043

Line #	Descripti	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total			
=======================================		========		×=====================================					
1631200100	HEATING S	YSTEM POWE	ER / CONT	ROL PANEL	1.00	Ea			
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402			
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402			

==========								
Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================		=======						
ESTIMATE TOTAL	263	\$12,440	\$6,382	. \$0	\$0	\$18,822		
SALES TAX	0.00%	\$0 \$0						
MATL MARKUP LABOR MARKUP	0.00% 0.00%	\$0	\$0					
EQUIPT MARKUP	0.00%			\$0	<b>^</b>			
SUB MARKUP	0.00%				\$0			
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0		
JOB .TOTAL						\$18,822		

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Estimate:

BLDG 6561 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Description: Project:

LIMITED EEAP (GLASSBid Date:

Location:

FORT KNOX, KY Job #: 94013.02

Sq. footage:

City indx:Louisville, KY

Sq. rootage:	City indx.boursviile, ki					
=======================================	S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
	========	======	•	========		======
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 207 3	\$776 \$11,333 \$331	\$1,601 \$4,710 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$16,043 \$402
TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	e.
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0
JOB TOTAL						\$18,822

Estimate: BLDG 6562 Date: 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: City indx:Louisville, KY Sq. footage: 4800.00 Description Line # . \_ \_ \_ \_ \_ \_ \_ Matl Labor Equipment Manhours \_\_\_\_\_\_\_ 0205543200 SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 4"DIAMETER 400.00 L.F. 0.00 Unit values 0.15 3.16 4.44 1.29 0.00 60.00 Totals \$0 \$1,262 \$514 \$0 \$1,776 0207183600 HVAC DEMO, MECH EQPT HEAVY ITEM 0.50 Ton Unit values 14.55 0.00 380.36 0.00 0.00 380.36 Totals 7.27 \$0 \$190 \$0 \$0 \$190 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE . 0208400600 200.00 L.F. 1.97 0.00 0.24 Unit values 0.07 0.00 2.21 \$395 \$47 Totals 14.20 \$0 \$0 \$442 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 100.00 Ea. 5.55 0.68 0.00 0.20 0.00 6.23 Unit values 20.00 \$0 \$555 \$68 Totals \$0 \$623 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. 5.91 259.60 35.47 300.98 Unit values 1.56 0.00 Totals 1.56 \$260 \$35 \$6 \$0 \$301 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. Unit values 0.11 1.92 2.96 0.17 0.00 5.06 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 109 \$356 \$2,585 \$644 \$0 \$3,585

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Line #	ne # Description					
	Manhours	Matl	Labor I	Equipment	Sub	Total
=======================================	_ = = = = = = = = = = = = = = = = = = =					
1554510245	HTG INFA-RI	O UNT GAS	ELEC IGN	(See Att	ached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0		18822.00 \$18,822
1562600137	GAS APPLIAN			BLE DIAPHR		77.
Unit values Totals	TYPE 1-1/4' 0.53 0.53		12.10 \$12	0.00	1.00 0.00 \$0	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$18,822	\$19,060

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================	========	=======	=======					
ESTIMATE TOTAL	110	\$582	\$2,597	\$644	\$18,822	\$22,645		
SALES TAX MATL MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0					
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00%		ŞU	\$0	\$0			
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,597	\$644	\$18,822	\$22,645 \$2,265 \$0 \$2,265		
JOB TOTAL						\$27,174		

Estimate: BLDG 6562

Date: 14-Oct-94

Description: COST ESTIMATE
Project: LIMITED EEAP (GLASSBID Date:
Location: FORT KNOX, KY Job #:

94013.02

Location:

Sq. footage: 4800.00 City indx:Louisville, KY CIMMADV

SUMMARY						
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	=======================================	========			
U02 SITEWORK U15 MECHANICAL	109 1	\$356 \$226	\$2,585 \$12	\$644 \$0	\$0 \$18,822	\$3,585 \$19,060
TOTAL	110	\$582	\$2,597	\$644	\$18,822	\$22,645
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,597	\$644	\$18,822	\$22,645 \$2,265 \$0 \$2,265
JOB TOTAL				•		\$27,174

\_\_\_\_\_\_ Estimate: BLDG 6562 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description \_\_\_\_\_ Matl Labor Equipment Manhours \_\_\_\_\_\_ 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 300.00 L.F. 2.22 Unit values 0.15 4.57 0.00 6.79 0.00 Totals 44.70 \$665 \$2,037 \$1,372 \$0 \$0 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES 50.00 L.F. 2.22 Unit values 0.15 4.57 0.00 0.00 6.79 Totals 7.45 \$229 \$0 \$111 \$0 \$340 A09 ELECTRICAL 53 \$776 \$1,601 \$0 \$0 \$2,377

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Line #	Description								
	Manhours			Equipment		Total			
=======================================									
1517010650	W/CPLGS			HEDULE 40,	275.00	L.F.			
Unit values Totals	0.44	4.17 \$1,147	10.30 \$2,833	0.00 \$0	0.00	14.47 \$3,980			
1517011310		CE PIPE ST: 10'OC 1/2"		SCH 40 THRD	W/CPLG & 330.00				
Unit values Totals	0.13 41.91	1.64 \$541	DIAM 2.88 \$949	0.00 \$0	0.00	4.52 \$1,490			
1519010320	ALUMINUM	REFLECTORS	W/HANGER	.S	38.00	Ea			
Unit values Totals	0.50 19.00	39.79 \$1,512	3.80 \$145	0.00 \$0	0.00	43.59 \$1,657			
1524105040	VACUUM PU	MP AND VEN	T PIPING		1.00	Ea			
Unit values Totals	3.00	738.35 \$738	120.15 \$120		0.00	858.50			
1552301020	CRV-100 G	AS FIRED B	URNER, 10	0 MBH & CO	MBUSTION 6.00	CHAMBER			
Unit values Totals	1.00 6.00	860.00 \$5,160	44.06 \$264		0.00	904.06 \$5,424			
1554510220	CO-RAY-VA	C VANTAGE	2 INFA-RD	HTG UNIT,	GAS 40 MB 2.00				
Unit values Totals		935.00 \$1,870	81.70 \$163		0.00	1016.70 \$2,033			
1556800120	CO-RAY-VA	C VANTAGE	2 VENT PI	PE	2.00	Ea			
Unit values Totals	1.60 3.20	70.00 \$140	76.50 \$153	0.00 \$0	0.00	146.50 \$293			
1574205220	ELECTRIC	THERMOSTAT	W/ COVER	AND WIRING	3.00	Fa			
Unit values Totals	1.00	75.00 \$225	27.55 \$83	0.00 \$0	0.00	102.55 \$308			
U15 MECHANICAL	207	\$11,333	\$4,710	\$0	\$0	\$16,043			

=======================================					=======		
Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	========	=======			======:		
1631200100	HEATING S	YSTEM POWI	ER / CONTR	ROL PANEL			
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	1.00 0.00 \$0	Ea. 401.34 \$402	
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402	

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Line #	Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
ESTIMATE TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822		
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	<b>\$</b> 0			
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0		
JOB TOTAL						\$18,822		

Estimate: BLDG 6562 Date: 14-Oct-94

Description: INFRARED HEATING SYSTEM COST ESTIMATE Project: LIMITED EEAP(GLASSBID Date:

Location: Sq. footage: Job #: 94013.02

FORT KNOX, KY City indx:Louisville, KY

=======================================	S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======					
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 207 3	\$776 \$11,333 \$331	\$1,601 \$4,710 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$16,043 \$402
TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND. PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0 ·	\$18,822 \$0 \$0 \$0
JOB TOTAL						\$18,822

\_\_\_\_\_\_\_ BLDG 6563 14-Oct-94 Date: Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: FORT KNOX, KY Job #: Location: City indx:Louisville, KY 4800.00 Sq. footage: Description Line # Equipment Matl Labor Sub Total Manhours \_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 400.00 L.F. 4 "DIAMETER Unit values 0.15 0.00 3.16 1.29 0.00 4.44 \$514 \$0 Totals 60.00 \$0 \$1,262 \$1,776 0207183600 HVAC DEMO, MECH EQPT HEAVY ITEM 0.50 Ton 0.00 380.36 0.00 380.36 0.00 Unit values 14.55 \$0 7.27 \$0 \$190 \$0 \$190 Totals 0208400600 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 200.00 L.F. 0.24 0.07 0.00 1.97 0.00 2.21 Unit values \$0 \$395 \$47 \$0 \$442 14.20 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 100.00 Ea. 0.68 0.00 5.55 0.00 6.23 Unit values 0.20 \$68 \$555 \$0 20.00 \$0 \$623 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 300.98 5.91 Unit values 1.56 259.60 35.47 0.00 1.56 \$6 \$0 \$301 Totals \$260 \$35 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. Unit values 0.17 1.92 2.96 5.06 0.11 0.00 5.35 \$96 \$9 \$0 Totals \$148 \$253 109 U02 SITEWORK \$356 \$2,585 \$644 \$0 \$3,585

Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub .	Total
=======================================	=======		=======			
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	I (See Atta	ched for 1	
Unit values Totals	0.00	0.00 \$0	0.00	0.00 \$0	18822.00 \$18,822	18822.00 \$18,822
1562600137	GAS APPLIA			BLE DIAPHR		
TT-de realway	TYPE 1-1/4 0.53	" PIPE SI 226.00	ZE 12.10	0.00	1.00	Ea. 238.10
Unit values Totals	0.53	\$226	\$12	\$0	\$0	\$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$18,822	\$19,060

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Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	=======================================						
ESTIMATE TOTAL	110	\$582	\$2,597	\$644	\$18,822	\$22,645	
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0		
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,597	\$644	\$18,822	\$22,645 \$2,265 \$0 \$2,265	
JOB TOTAL				•		\$27,174	

BLDG 6563

Date:

14-Oct-94

Description: Project:

COST ESTIMATE

LIMITED EEAP (GLASSBid Date:

Job #:

94013.02

Location:

FORT KNOX, KY 4800.00

Sq. footage:

City indx:Louisville, KY

SUMMARY						========
	Manhours	Matl	Labor	Equipment	Sub	Total
==========						=======
U02 SITEWORK U15 MECHANICAL	109 1	\$356 \$226	\$2,585 \$12	\$644 \$0	\$0 \$18,822	\$3,585 \$19,060
TOTAL	110	\$582	\$2,597	\$644	\$18,822	\$22,645
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	. \$0			
EQUIPT MARKUP SUB MARKUP	0.00%		,	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,597	\$644	\$18,822	\$22,645 \$2,265 \$0 \$2,265
JOB TOTAL						\$27,174

Estimate: BLDG 6563 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description Line # Manhours Matl Labor Equipment Sub 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 300.00 L.F. 2.22 4.57 0.00 6.79 0.15 0.00 Unit values 44.70 \$665 \$1,372 \$0 \$0 \$2,037 Totals CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES
0.15 2.22 4.57 0.00 50.00 L.F. 6.79 Unit values 0.00 \$229 \$0 \$0 \$340 Totals 7.45 \$111 \$0 \$776 \$1,601 \$0 53 \$2,377 A09 ELECTRICAL

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
=========	=====-					
			י חדרי כי	ישביחווו.ב או	, THREADED	All DIAM
1517010650	W/CDLGS				275.00	L.F.
Unit values Totals		4.17 \$1,147			\$0	\$3,980
1517011310	GAS SERVI	CE PIPE ST 10'OC 1/2"	EEL GALV	SCH 40 TH	RD W/CPLG 330.00	& HNGR SZD L.F.
Unit values Totals	0.13 41.91	1.64 \$541	2.88 \$949	0.00	0.00	
1519010320	ALUMINUM :	REFLECTORS	W/HANGE	RS	38.00	Fa
Unit values Totals	0.50 19.00	39.79 \$1,512	3.80 \$145	0.00	0.00	43.59 \$1,657
1524105040	VACUUM PU	MP AND VEN	T PIPING		1.00	Ea
Unit values Totals	3.00 3.00	738.35 \$738	120.15 \$120		0.00	
1552301020	CRV-100 G	AS FIRED B	URNER, 1	00 MBH &	COMBUSTION	CHAMBER Ea.
Unit values Totals	1.00	860.00 \$5,160	44.06 \$264	0.00	0.00	904.06 \$5,424
1554510220	CO-RAY-VA	C VANTAGE	2 INFA-RI	HTG UNI	r, GAS 40 M 2.00	BH Ea.
Unit values Totals	4.00	935.00 \$1,870	81.70 \$163	0.00	0.00	
1556800120	CO-RAY-VA	C VANTAGE	2 VENT P	IPE	2.00	Ea
Unit values Totals	1.60 3.20	70.00 \$140	76.50 \$153	0.00	0.00	146.50
1574205220	ELECTRIC	THERMOSTAT	W/ COVE	R AND WIR	ING 3.00	ਇਤ
Unit values Totals	1.00	75.00 \$225	27.55 \$83	0.00 \$0	0.00	102.55
U15 MECHANICAL	207	\$11,333	\$4,710	\$(	\$0	\$16,043

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Line #	Description	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======================================					
1631200100	HEATING SY	STEM POWE	R / CONTR	OL PANEL	1.00	Fa
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================	=======	=======	=======				
.•			•		•		
ESTIMATE TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822	
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0				
EQUIPT MARKUP SUB MARKUP	0.00%		ŞU	\$0	\$0		
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0 \$0	
TOR TOTAL						\$18.822	

\_\_\_\_\_\_ Estimate: BLDG 6563 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBID Date:

Location:

JOB TOTAL

FORT KNOX, KY Job #: 94013.02

Sq. footage:	City indx:Louisville, KY								
=======================================	SUMMARY								
	Manhours	Matl	Labor	Equipment	Sub	Total			
	=======	=======							
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 207 3	\$776 \$11,333 \$331	\$1,601 \$4,710 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$16,043 \$402			
TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822			
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0	**					
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0				
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	. \$0	\$0	\$18,822 \$0 \$0 \$0			

\$18,822

14-Oct-94 BLDG 6564 Date: Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: Job #: FORT KNOX, KY Location: City indx:Louisville, KY 4800.00 Sq. footage: Description Equipment Labor Matl Manhours \_\_\_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 400.00 L.F. 4"DIAMETER 0.00 4.44 0.00 3.16 1.29 0.15 Unit values \$0 \$1,776 \$514 \$0 \$1,262 60.00 Totals HVAC DEMO, BOILER GAS/OIL STL >150MBH 0207180380 1.00 Ea. 0.00 0.00 323.82 323.82 Unit values 0.00 12.00 \$0 \$0 \$324 \$0 \$324 12.00 Totals HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.50 Ton 380.36 0.00 0.00 380.36 0.00 14.55 Unit values \$0 \$190 \$190 7.27 \$0 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 200.00 L.F. 2.21 0.24 0.00 1.97 0.07 0.00 Unit values \$47 \$0 \$442 14.20 \$395 \$0 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 100.00 Ea. DIAMETER PIPE 0.68 0.00 6.23 5.55 0.20 0.00 Unit values \$68 \$0 \$623 \$555 20.00 \$0 Totals CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 0266907800 1.00 Ea. 300.98 5.91 0.00 259.60 35.47 1.56 Unit values \$35 \$6 \$0 \$301 1.56 \$260 Totals GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN 0268520550 50.00 L.F. END, TAR COAT&WRAP 1"DIAM 0.00 5.06 0.17 0.11 1.92 2.96 Unit values \$0 \$253 \$9 5.35 \$96 \$148 Totals \$3,909 \$0 \$644 \$356 \$2,909 U02 SITEWORK 121

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Line #	Description	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========	======				
1554510245	HTG INFA-R	D UNT GAS	ELEC IG	N (See Att	ached for	Breakdown)
Unit values Totals	0.00	0.00 \$0	0.00 \$0	0.00 \$0	18822.00	18822.00 \$18,822
1562600137	GAS APPLIA	NCE REGUL		UBLE DIAPHE		T <sub>a</sub>
Unit values Totals	TYPE 1-1/4 0.53 0.53	226.00 \$226	12.10 \$12	0.00	1.00 0.00 \$0	238.10 \$238
U15 MECHANICAL	1	\$226	\$12	\$0	\$18,822	\$19,060

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Line #	ine # Description							
	Manhours	Matl	Labor	Equipment	Sub	Total		
==========	======							
ESTIMATE TOTAL	122	\$582	\$2,921	\$644	\$18,822	\$22,969		
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	. \$0	\$0			
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,921	\$644	\$18,822	\$22,969 \$2,297 \$0 \$2,297		
JOB TOTAL						\$27,563		

Estimate: BLDG 6564

Date: 14-Oct-94

Description: COST ESTIMATE

LIMITED EEAP(GLASSBid Date:

Project: Location: Sq. footage: 4800.00

FORT KNOX, KY Job #: 94013.02 4800.00 City indx:Louisville, KY 

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	Manhours	Matl	Labor	Equipment	Sub	Total
=============					=======	=======
U02 SITEWORK U15 MECHANICAL	121 L 1	\$356 \$226	\$2,909 \$12	\$644 \$0	\$0 \$18,822	\$3,909 \$19,060
TOTAL	122	\$582	\$2,921	\$644	\$18,822	\$22,969
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		1.	\$0	\$º	
TOTAL BEFORE CONTINGENCY BOND PROFIT	CONTINGENC 10.00% 0.00% 10.00%	\$582	\$2,921	\$ <b>644</b>	\$18,822	\$22,969 \$2,297 \$0 \$2,297
JOB TOTAL						\$27,563

A09 ELECTRICAL

\_\_\_\_\_\_ Estimate: BLDG 6564 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: Sq. footage: City indx:Louisville, KY Description \_\_\_\_\_ Labor Equipment Manhours Matl \_\_\_\_\_\_ 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 300.00 L.F. 2.22 4.57 0.00 Unit values 0.15 0.00 Totals 44.70 \$665 \$1,372 \$0 \$0 \$2,037 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES 50.00 L.F. Unit values 0.15 2.22 4.57 0.00 0.00 6.79 Totals \$0 7.45 \$111 \$229 \$0 \$340

\$1,601

\$0

\$0

\$2,377

\$776

53

		=======	=====:			
Line #	Description	on				
	Manhours			Equipment		
#===========	========	=======	======			
1517010650	W/CDLGS			CHEDULE 40,	275.00	L.F.
Unit values Totals	0.44	4.17 \$1,147	10.30 \$2,833	0.00 \$0	0.00 \$0	14.47 \$3,980
1517011310	FOR CURC 1	0100 1/2"	DTAM	SCH 40 THRD	330.00	L.F.
Unit values Totals	0.13 41.91	1.64 \$541	2.88	0.00 \$0	0.00 \$0	4.52 \$1,490
1519010320	ALUMINUM F	REFLECTORS	W/HANGE	RS	38.00	Fo
Unit values Totals	0.50 19.00	39.79 \$1,512			0.00	43.59 \$1,657
1524105040	VACUUM PUN	MP AND VEN			1.00	Fo
Unit values Totals	3.00 3.00	738.35 \$738	120.15 \$120	0.00 \$0	0.00	858.50 \$858
1552301020	CRV-100 G2	AS FIRED B	URNER, 1	00 йвн % СС	MBUSTION 6.00	CHAMBER
Unit values Totals	1.00	860.00 \$5,160	44.06 \$264	0.00 \$0	0.00	904.06 \$5,424
1554510220	CO-RAY-VA	C VANTAGE	2 INFA-R	D HTG UNIT,	GAS 40 M 2.00	BH
Unit values Totals	4.00	935.00 \$1,870	81.70 \$163	0.00	0.00	1016.70 \$2,033
1556800120	CO-RAY-VA	C VANTAGE	2 VENT P	IPE	2.00	Fa
Unit values Totals	1.60 3.20	70.00 \$140	76.50 \$153	0.00 \$0		146.50 \$293
1574205220	ELECTRIC :	THERMOSTAT	W/ COVE	R AND WIRING		T-
Unit values Totals	1.00	75.00 \$225	27.55 \$83		3.00 0.00 \$0	102.55 \$308
U15 MECHANICAL	207	\$11,333	\$4,710	\$0	\$ <b>0</b>	\$16,043

Line #	Descripti	on				
	Manhours	Matl	Labor Eq	quipment	Sub	Total
=======================================						
1631200100	HEATING S	YSTEM POWER	R / CONTROI	PANEL	1.00	Fa
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

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Line #	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total	
=======================================							
ESTIMATE TOTAL	263	\$12,440	\$6,382	\$0	\$0	\$18,822	
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0			
SUB MARKUP	0.00%			Ų ū	\$0		
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0	
JOB TOTAL						\$18,822	

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Estimate: BLDG 6564

Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Description: Project:

LIMITED EEAP (GLASSBid Date:

Location: Sq. footage:

FORT KNOX, KY Job #: 94013.02 City indx:Louisville, KY

Sq. footage:	city indx:boursviile, ki					
=======================================	S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======					
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 207 3	\$776 \$11,333 \$331	\$1,601 \$4,710 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$16,043 \$402
TOTAL	263	\$12,440	\$6,382	. \$0	\$0	\$18,822
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0		
SUB MARKUP	0.00%			ŞÜ	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$12,440	\$6,382	\$0	\$0	\$18,822 \$0 \$0 \$0
JOB TOTAL						\$18,822

Date: '14-Oct-94 BLDG 6576 Estimate: COST ESTIMATE Description: LIMITED EEAP(GLASSBid Date: Project: FORT KNOX, KY Job #: Location: City indx:Louisville, KY 6900.00 Sq. footage: . Description Equipment Matl Labor \_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 4"DIAMETER 320.00 L.F. 0.00 Unit values 0.15 3.16 1.29 0.00 4.44 48.00 \$0 \$411 \$0 Totals \$1,010 \$1,421 0207180380 HVAC DEMO, BOILER GAS/OIL STL >150MBH 0.00 Ea. 0.00 323.82 0.00 Unit values 12.00 0.00 323.82 \$0 0.00 \$0 \$0 \$0 \$0 Totals HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.75 Ton 14.55 0.00 380.36 0.00 0.00 380.36 Unit values \$0 10.91 \$0 \$285 \$0 \$285 Totals REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 0.07 0.00 1.97 0.24 0.00 2.21 Unit values 12.07 \$0 \$336 \$40 \$0 \$376 Totals 0208401000 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 50.00 Ea. DIAMETER PIPE Unit values 0.20 0.00 5.55 0.68 6.23 0.00 Totals 10.00 \$0 \$278 \$34 \$0 \$312 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. Unit values 1.56 259.60 35.47 5.91 300.98 0.00 Totals 1.56 \$6 \$260 \$35 \$0 \$301 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. Unit values 0.11 1.92 2.96 0.17 5.06 0.00 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 88 \$2,092 \$356 \$500 \$0 \$2,948

		=======	=======			
Line #	Descriptio	n				
	Manhours	Matl	Labor	Equipment	Sub	Total
_======================================	========					
1554510245	HTG INFA-R	D UNT GAS	ELEC IGN	N (See Att	ached for	Breakdown)
Unit values Totals	8.00 8.00	760.00 \$760	163.40 \$163	0.00 \$0		22610.40
1562600137	GAS APPLIA			BLE DIAPHR		_
Unit values Totals	TYPE 1-1/4 0.53 0.53	" PIPE S12 226.00 \$226	12.10 \$12	0.00	1.00 0.00 \$0	Ea. 238.10 \$238
U15 MECHANICAL	9	\$986	\$175	. \$0	\$21,687	\$22,848

=======================================	========					========
Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========				========	
ESTIMATE TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796
SALES TAX	0.00% 0.00%	\$0 \$0				
MATL MARKUP LABOR MARKUP	0.00%	Ų O	\$0	**		
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
	ONTINGENC	\$1,342	\$2,267	\$500	\$21,687	\$25,796
CONTINGENCY BOND	10.00% 0.00%					\$2,580 \$0
PROFIT	10.00%					\$2,580
JOB TOTAL						\$30,955

Estimate: BLDG 6576 Date:
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #:

Date: 14-Oct-94

94013.02

Sq. footage: 6900.00

City indx:Louisville, KY

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SUMMARY	

	SUMMARI					
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=======					=======
U02 SITEWORK U15 MECHANICAL	88 9	\$356 \$986	\$2,092 \$175	\$500 \$0	\$0 \$21,687	\$2,948 \$22,848
TOTAL	97	\$1,342	\$2,267	\$500	\$21,687	\$25,796
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0	·		
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,267	\$500	\$21,687	\$25,796 \$2,580 \$0 \$2,580
JOB TOTAL						\$30,955

Estimate: BLDG 6576 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: 94013.02 FORT KNOX, KY Job #: Location: City indx:Louisville, KY Sq. footage: Description \_\_\_\_\_ Manhours Matl Labor Equipment 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 230.00 L.F. AND RECEPTACLES 6.79 0.15 2.22 4.57 0.00 0.00 Unit values Totals 34.27 \$510 \$1,052 \$0 \$0 \$1,562 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, 0913100200 INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. 2.22 4.57 0.00 0.00 Unit values 0.15 Totals 17.88 \$266 \$549 \$0 \$0 \$815 \$776 \$1,601 \$0 \$0 \$2,377 A09 ELECTRICAL 53

Line #	Description				
	Manhours Matl	Labor Ed			Total
==========	=======================================				========
1517010650	BLACK STEEL RADIA			THREADED, 220.00	L.F.
Unit values Totals	0.44 4.17 97.68 \$917	7 10.30 7 \$2,267	0.00 \$0	0.00 \$0	14.47 \$3,184
1517011310	GAS SERVICE PIPE FOR CVRG 10'OC 1			W/CPLG & 340.00	
Unit values Totals	0.13 1.64	/2" DIAM 1 2.88 3 \$978	0.00	0.00	4.52
1519010320	ALUMINUM REFLECTO	ORS W/HANGERS		29.00	Fa
Unit values Totals		3.80 \$110	0.00	0.00	43.59 \$1,264
1524105040	VACUUM PUMP AND V	VENT PIPING		1.00	E-
Unit values Totals	3.00 738.35 3.00 \$738		0.00 \$0	0.00	858.50 \$858
1552301020	CRV-90 GAS FIRED	BURNER, 90 ME	BH & COMBU	STION CH	
Unit values Totals	1.00 860.00 6.00 \$5,160			0.00	904.06 \$5,424
1554510160	CO-RAY-VAC VANTAG	GE 2 INFA-RD	HTG UNT, G	AS 100MB 1.00	
Unit values Totals	6.00 1065.00 6.00 \$1,065	163.40 \$163		0.00	1228.40 \$1,228
1554510220	CO-RAY-VAC VANTAG	SE 2 INFA-RD H	HTG UNIT, G	AS 40 MB 4.00	
Unit values Totals	4.00 935.00 16.00 \$3,740		0.00	0.00	1016.70 \$4,067
1556800120	CO-RAY-VAC VANTAG	SE 2 VENT PIPE	E	5.00	E o
Unit values Totals	1.60 70.00 8.00 \$350		. 0.00	0.00	146.50 \$732
1574205220	ELECTRIC THERMOST	CAT W/ COVER A	AND WIRING	6 00	Po.
Unit values Totals	1.00 75.00 6.00 \$450		0.00 \$0	6.00 0.00 \$0	102.55 \$615

Line #	Descript	ion				
	Manhours	Matl	Labor	Equipment	Sub ·	Total
=======================================		==========				
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908
1631200100	HEATING	SYSTEM POWER	R / CONTI	ROL· PANEL	1.00	Ea.
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
	257	¢15 220	¢6 110	¢0	ė o	621 607
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$*0	\$21,687 \$0 \$0 \$0
JOB TOTAL		,		•		\$21,687

Estimate: BLDG 6576 Date: 14-Oct-94
Description: INFRARED HEATING SYSTEM COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #: 94013.02
City indx:Louisville, KY . \_\_\_\_\_\_

JOB TOTAL

=======================================	======= S	UMMARY	=======			
	Manhours	Matl	Labor	Equipment	Sub	Total
##############	=======					
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	53 201 3	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402
TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP	0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0		
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE CO CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0

\$21,687

Estimate: BLDG 6577 Date: 14-Oct-94 COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: FORT KNOX, KY Job #: 94013.02 Location: 6900.00 City indx:Louisville, KY Sq. footage: . Description Line # \_\_\_\_\_ Equipment Manhours Matl \_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 4"DIAMETER 320.00 L.F. Unit values 0.15 0.00 3.16 1.29 0.00 4.44 48.00 Totals \$0 \$1,010 \$411 \$0 \$1,421 0207180380 HVAC DEMO.BOILER GAS/OIL STL >150MBH 1.00 Ea. 12.00 0.00 323.82 0.00 Unit values 0.00 323.82 \$0 Totals 12.00 \$0 \$324 \$0 \$324 HVAC DEMO, MECH EQPT HEAVY ITEM 0207183600 0.75 Ton 14.55 380.36 0.00 380.36 0.00 0.00 Unit values \$0 \$285 \$0 Totals 10.91 \$0 \$285 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 170.00 L.F. 1.97 0.24 0.07 0.00 0.00 2.21 Unit values \$336 \$40 12.07 \$0 \$0 \$376 Totals REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 50.00 Ea. 0.20 Unit values 0.00 5.55 0.68 0.00 6.23 Totals 10.00 \$0 \$278 \$34 \$0 \$312 0266907800 CUT IN VALVES, W/DUCK TIP GASKET, 4" DIAMETER 1.00 Ea. 1.56 Unit values 259.60 35.47 5.91 0.00 300.98 Totals 1.56 \$260 \$35 \$6 \$0 \$301 0268520550 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 1"DIAM 50.00 L.F. Unit values 0.11 1.92 2.96 0.17 5.06 0.00 Totals 5.35 \$96 \$148 \$9 \$0 \$253 U02 SITEWORK 100 \$356 \$2,416 \$500 \$0 \$3,272

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
1554510245	HTG INFA-R	D UNT GAS	ELEC IĠN	I (See Atta	ched for I	
Unit values Totals	8.00	760.00 \$760	163.40 \$163	0.00		22610.40
1562600137	GAS APPLIA			BLE DIAPHR	AGM 1.00	Ea
Unit values Totals	0.53	226.00 \$226	12.10	0.00 \$0	0.00	238.10 \$238
U15 MECHANICAL	9	\$986	\$175	\$0	\$21,687	\$22,848

	========	=======	=======			=======
Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
ESTIMATE TOTAL	109	\$1,342	\$2,591	\$500	\$21,687	\$26,120
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		Ųΰ	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$1,342	\$2,591	\$500	\$21,687	\$26,120 \$2,612 \$0 \$2,612
JOB TOTAL						\$31,344

JOB TOTAL

Estimate: Description:	BLDG 6577 COST ESTIM LIMITED EE		Date:	14-Oct-94		
Project: Location: Sq. footage:	FORT KNOX, 6900.00		Job #:	94013.02 :Louisville,	КУ	
	SU	MMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
	:======================================			========	======	=======
U02 SITEWORK U15 MECHANICA	100 AL 9	\$356 \$986	\$2,416 \$175	. \$500 \$0	\$0 \$21,687	\$3,272 \$22,848
TOTAL	109	\$1,342	\$2,591	\$500	\$21,687	\$26,120
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP	0.00%		•	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND	CONTINGENC 10.00%	\$1,342	. \$2,591	\$500	\$21,687	\$26,120 \$2,612
PROFIT	0.00%					\$0 \$2,612

\$31,344

\_\_\_\_\_\_\_ Estimate: BLDG 6577 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE Description: LIMITED EEAP (GLASSBid Date: Project: Job #: 94013.02 FORT KNOX, KY Location: City indx:Louisville, KY Sq. footage: Description Labor Equipment Sub Manhours Matl \_\_\_\_\_\_ 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 230.00 L.F. AND RECEPTACLES 4.57 0.00 Unit values 0.15 2.22 0.00 6.79 Totals 34.27 \$510 \$1,052 \$0 \$0 \$1,562 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION. INCL CONDUIT, WIRE, AND RECEPTACLES
0.15 2.22 4.57 0.00 120.00 L.F. Unit values 6.79 0.00 Totals \$0 17.88 \$266 \$549 \$0 \$815 A09 ELECTRICAL 53 \$776 \$1,601 . \$0 \$0 \$2,377

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Line #	Description	on				
=======================================	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	========					
1517010650	BLACK STE	EL RADIANT	PIPE, S	CHEDULE 40,	THREADED,	4" DIAM L.F.
Unit values Totals	0.44 97.68	4.17 \$917	10.30 \$2,267	0.00	0.00	14.47
1517011310	GAS SERVIO	CE PIPE ST	EEL GALV	SCH 40 THR	D W/CPLG 8	HNGR SZD
Unit values Totals	0.13 43.18	1.64 \$558	2.88 \$978	0.00	0.00	4.52 \$1,536
1519010320 Unit_values	ALUMINUM I	REFLECTORS	W/HANGE	RS	29 00	Pa
Unit values Totals	0.50 14.50	39.79 \$1,154	3.80 \$110	0.00 \$0	0.00	43.59 \$1,264
1524105040	VACUUM PUI	MP AND VEN	T PIPING		7 00	D-
Unit values Totals	3.00 3.00	738.35 \$738	120.15 \$120	0.00 \$0	1.00 0.00 \$0	858.50 \$858
1552301020						Andrew Control of the
Unit values Totals	1.00	860.00 \$5,160	44.06 \$264	0.00 \$0	6.00 0.00 \$0	904.06
1554510160					7 00	D-
Unit values Totals	6.00	1065.00 \$1,065	163.40 \$163	0.00 \$0	0.00	1228.40
1554510220	CO-RAY-VAC	C VANTAGE	2 INFA-R	D HTG UNIT,	GAS 40 ME 4.00	H
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327			
1556800120	CO-RAY-VAC	VANTAGE	2 VENT P	IPE	F 00	
Unit values Totals	1.60	70.00 \$350	76.50 \$382		5.00 0.00 \$0	146.50 \$732
1574205220	ELECTRIC T	THERMOSTAT	W/ COVE	R AND WIRING		Eo
Unit values Totals	1.00	75.00 \$450	27.55 \$165		6.00 0.00 \$0	102.55 \$615

Line #	Descript	Description						
	Manhours	Matl	Labor	Equipment	Sub	Total		
=======================================	=======							
U15 MECHANICAL	201	\$14,132	\$4,776	\$0	\$0	\$18,908		
1631200100	HEATING	SYSTEM POWE	R / CONT	ROL PANEL		_		
		222 56	F0 F0	0.00	1.00			
Unit values	2.96	330.76	70.58	0.00	0.00	401.34		
Totals	2.96	\$331	\$71	\$0	\$0	\$402		
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402		

	========	========				.=======
Line #	Descripti	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======					
ESTIMATE TOTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			. \$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
JOB TOTAL						\$21,687

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Estimate: BLDG 6577 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Description: Project:

LIMITED EEAP(GLASSBid Date:

Job #: FORT KNOX, KY

Location: Sq. footage:

City indx:Louisville, KY

S	sq. footage:			city indx	:DOUISVIIIE,		
.=	:======================================	S	UMMARY				
-		Manhours	Matl	Labor	Equipment	Sub	Total
=	:==========	=======	=======				=========
U	09 ELECTRICAL 15 MECHANICAL 16 ELECTRICAL	201	\$776 \$14,132 \$331	\$1,601 \$4,776 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$2,377 \$18,908 \$402
T	OTAL	257	\$15,239	\$6,448	\$0	\$0	\$21,687
M	ALES TAX ATL MARKUP ABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
E	QUIPT MARKUP UB MARKUP	0.00%			\$0	\$0	
В	OTAL BEFORE CONTINGENCY OND ROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$15,239	\$6,448	\$0	\$0	\$21,687 \$0 \$0 \$0
J	OB TOTAL					**	\$21,687

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# **ECO - 1: INFRARED HEATING CALCULATIONS**

1 OF 3		MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	
PAGE 1		0.08	0.02	0.03	0.00	90.0	0.00	0.08	0.00	0.00	0.05	0.00	0.00	0.00	
	<u>тт'т</u>	11	11	п	11	11	11	II	Ħ	Ħ	н	П	11	n	1
	E SETPOINT: 60	F TEMP DIFF X 0.019	F TEMP DIFF X 0.81	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	
	ATURI URE	29	29	59	59	29	29	29	59	59	29	29	29	29	
	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	VOL (CUFT) X	RIMETER X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ HR-SF-F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	
	BUILDING H OUTSIDE D TEMPERAT	73600	LINEAR FEET OF PERIMETER	0.105	0.176	0.389	0.17	1.235	0.65	0.56	0.214	0.56	0.56	0.615	
		×	AR FE	×	×	×	×	×	×	×	×	×	×	`×	
	ı	AIR CHGS	LINE	AREA (SF)	AREA (SF)	- AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	- AREA (SF) -	ı
	6560	-	320	4800		2440		1123			1372			25	
	BUILDING NUMBER:	INFILTRATION LOSSES = _	FLOOR LOSSES =	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	FACE BRICK/BLK WALL =	8" CINDER BLOCK WALL =	CORR MTL PNL WALL =	CLR SGL PANE WINDOWS =	TINTED DBL PANE WIN'W =	METAL ROLL UP DOORS =	METAL GLAZED O'HEAD DR =	LG MTL SLIDING DOOR =	METAL PERSONNEL DR=	MTL/ GLAZED PERSONNEL=	

MBTU / HR MJ/HR

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TOTAL BASELINE HEAT LOSSES

	iL.	T KNOX	LIMI	FT KNOX LIMITED EEAP (GLASS)	9	LASS)			**
	EC	ECO - 1: INFR	ARED	: INFRARED HEATING CALCULATIONS	rc T	JLATIONS			
								PAGE	PAGE 2 OF 3
BUILDING NUMBER:	6560		BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUF TURE	E SETPOINT:	7 - 14 7 - 14		
INFILTRATION LOSSES =	<del></del>	AIR CHGS X	73600	VOL (CU FT) X	54 F	F TEMP DIFF X 0.019	11	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEAR F	EET OF P	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	11	0.01	MBTU / HR
SURFACE HEAT LOSSES									
FLAT BUILT UP ROOF =	4800	AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	Ħ	0.03	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	н	0.05	MBTU / HR
CORR MTL PNL WALL =	0	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
CLR SGL PANE WINDOWS =	1123	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.07	MBTU / HR
TINTED QBL PANE WIN'W =	0	AREA (SF) X	0.65	Ų VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
WOOD GLAZED O'HEAD DR =	1372	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.02	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) 'X	54	F TEMPERATURE DIFFERENCE	i)	0.00	MBTU / HR

MBTU / HR MJ/HR

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TOTAL ECO HEAT LOSSES

### **ECO - 1: INFRARED HEATING CALCULATIONS**

PAGE 3 OF 3

6560

**BUILDING NUMBER** 

	BASELINE	ECO - 1
SYSTEM EFFICIENCY	%09	%06
OUTSIDE DESIGN TEMP (F)	-	-
HTG TEMP SETPOINT (F)	09	55
HEATING DEGREE DAYS	4616	3396
TOTAL HEAT LOSSES	900	90.0
(MBTU / HR)	0.20	0.20
\$ /MBTU -FUEL OIL	\$6.60	\$6.60
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62
\$ /MBTU -PPG	\$10.84	\$10.84

GLOSSARY OF TERMS
1 MBTU = 1055 MJ
0.019=CONSTANT
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

		MBTUMR		MBTUMR	MBTU/YR MJ/YR
(0	MBTUMR	887.50	MBTU/YR	435.29	452.21 477,080.96
METHO	887.50		435.29	·	
DAY	ii	п	П	II	11 11
(DEGREE	HRS/DAY	-	HRS/DAY	<b>-</b>	ON SAVINGS
IG ENERGY CONSUMPTION (DEGREE DAY METHOD)	MBTU/HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	CORR FACTOR	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	CORR FACTOR	UAL HEATING ENERGY CONSUMPTION SAVINGS
зу с	4616 59	×	3396 54	×	NG EN
ATING ENER	MBTU/HR X SYS EFF X	MBTU/YR	MBTU/HR X SYS EFF X	MBTU/YR	ANNUAL HEATII
ANNUAL HEATIN	0.28	887.50	0.26	435.29	ECO - 1 ANN
A	BASELINE =		ECO - 1 =		

	ANNOAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST			
BASELINE =	887.50	MBTU/YR X 6.6	6.6	\$ /MBTU	11	5,857.50 \$ MR	\$ YR
ECO - 1 =	435.29	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,011.04 \$ MR	* VR
	ECO - 1 ANNI	JAL HEATING E	ENERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 3,846.46 \$ /YR	11	3,846.46	\$ MR

# ECO - 1: INFRARED HEATING CALCULATIONS

		:						PAGE 1	: 1 OF 3
BUILDING NUMBER:	6561		BUILDING } OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	NTURE URE	E SETPOINT: 60	<u>ккк</u>		
INFILTRATION LOSSES =		AIR CHGS X	73600	VOL (CUFT) X	29	F TEMP DIFF X 0.019	n -	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEAR FI	LINEAR FEET OF PERIMETER	RIMETER X	29	F TEMP DIFF X 0.81	. 11	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	4800	AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	0.03	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	AREA (SF) X	0.389	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	п	90.0	MBTU / HR
CORR MTL PNL WALL =		AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
CLR SGL PANE WINDOWS =	1123	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	II	0.08	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	. "	00.0	MBTU / HR
METAL ROLL UP DOORS =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL GLAZED O'HEAD DR =	1372	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	n	0.02	MBTU / HR
LG MTL SLIDING DOOR =		AREA(SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA(SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	н	0.00	MBTU/HR

MBTU / HR MJ/HR

0.28 299.19

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**TOTAL BASELINE HEAT LOSSES** 

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# **ECO - 1: INFRARED HEATING CALCULATIONS**

								PAGE	PAGE 2 OF 3
BUILDING NUMBER:	6561		BUILDING OUTSIDE TEMPER/	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUR! URE	E SETPOINT: 55 F	<u> </u>		
INFILTRATION LOSSES =	-	AIR CHGS X	73600	VOL (CUFT) X !	54 F	F TEMP DIFF X 0.019	11	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEAR FE	ET OF P	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	11	0.01	MBTU/HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	4800	AREA (SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.03	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	Ii	0.05	MBTU / HR
CORR MTL PNL WALL =	0	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
CLR SGL PANE WINDOWS =	1123	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	Ħ	0.07	MBTU / HR
TINTED DBL PANE WIN'W =	. 0	AREA (SF) X	0.65		54	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
METAL ROLL UP DOORS =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	00.0	MBTU / HR
WOOD GLAZED O'HEAD DR =	1372	AREA (SF) X	0.214		54	F TEMPERATURE DIFFERENCE	II	0.02	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	Ħ	00.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56		54	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR

MBTU / HR MJ/HR

0.26 273.83

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**TOTAL ECO HEAT LOSSES** 

### ECO - 1: INFRARED HEATING CALCULATIONS

	BASELINE	ECO - 1	
SYSTEM EFFICIENCY	%09	%06	
OUTSIDE DESIGN TEMP (F)	·	-	=
HTG TEMP SETPOINT (F)	09	55	0.0
HEATING DEGREE DAYS	4616	3396	.8
TOTAL HEAT LOSSES (MBTU / HR)	0.28	0.26	S S
\$ /MBTU -FUEL OIL	\$6.60	\$6.60	}
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62	
\$ /MBTU -PPG	\$10.84	\$10.84	

BUILDING NUMBER 6561
GLOSSARY OF TERMS
1 MBTU = 1055 MJ
0.019=CONSTANT
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

	ANNUAL HEA	ATING ENERGY	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	N (DEGREE D	AY ME	тнор)		
BASELINE =	0.28	SYS EFF X 50	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	24 HRS/DAY	= 887	887.50 MBTU/YR	œ	
	887.50	MBTU/YR	CORR FACTOR	-	11	887.50	MBTUMR	JYR
ECO - 1 =	0.26	SYS EFF X 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	24 HRS/DAY	= 436	435.29 MBTU/YR	œ	
	435.29	MBTU/YR >	K CORR FACTOR	<del></del>	11	435.29	MBTU/YR	JYR
	ECO - 1	ANNUAL HEATING	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	TION SAVINGS	11 11	452.21	MBTU/YR 96 MJ/YR	JYR

	ANNUAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST			
BASELINE =	887.50	MBTU/YR X 6.6	6.6	\$ /MBTU	ii	= 5,857.50 \$ MR	\$ MR
ECO . 1 ==	435.29	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,011.04 \$ MR	\$ MR
	ECO - 1 ANNI	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 3,846.46 \$ /YR	ENERGY	COST SAVING	II	3,846.46	\$ \7R

# **ECO - 1: INFRARED HEATING CALCULATIONS**

	•								PAGE 1	1 OF 3
BUILDING NUMBER:	6562	1		BUILDING H OUTSIDE DI TEMPERATI	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TUR JRE	E SETPOINT: 60	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		
INFILTRATION LOSSES =	-	AIR CHGS X	×	73600	VOL (CU FT) X	29	F TEMP DIFF X 0.019	11	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEA	R	LINEAR FEET OF PERIMETER	IMETER X	59	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES										
FLAT BUILT UP ROOF =	4800	AREA (SF)	×	0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.03	MBTU/HR
FACE BRICK/BLK WALL =		AREA (SF)	×	0.176	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	AREA (SF)	×	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	90.0	MBTU / HR
CORR MTL PNL WALL =		AREA (SF)	×	0.17	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	П	00.00	MBTU/HR
CLR SGL PANE WINDOWS =	1123	AREA (SF)	×	1.235	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.08	MBTU / HR
TINTED DBL PANE WIN'W =	•	AREA (SF)	×	0.65	U VALUE (BTU/ HR - SF - F) X .	29	F TEMPERATURE . DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =		AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL GLAZED O'HEAD DR =	1372	- AREA (SF)	×	0.214	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	tt	0.02	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF)	×	0.615	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
					TOTAL BASEL	N.	TOTAL BASELINE HEAT LOSSES	11	0.28	MBTU / HR
								11	299.19	MJ/HR

# ECO - 1: INFRARED HEATING CALCULATIONS

								PAGE	PAGE 2 OF 3
BUILDING NUMBER:	6562		BUILDING OUTSIDE TEMPER/	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUR TURE	E SETPOINT: 55	<u></u>		
INFILTRATION LOSSES =	<b>←</b>	AIR CHGS X	73600	VOL (CU FT) X	54 F	F TEMP DIFF X 0.019	11	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEAR FEET OF	ET OF P	PERIMETER X	54 F	F TEMP DIFF X 0.81	H	0.01	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	4800	AREA (SF) X	0.105	TU/	2,4	F TEMPERATURE	ı	60	an / HEAM
FACE BRICK/BLK WALL =	0	(SF)	0.176	U VALUE (BTU/ HR - SF - F) X	54	DIFFERENCE F TEMPERATURE DIFFERENCE	1 11	0.00	MBTU/HR
8" CINDER BLOCK WALL =	2440	AREA (SF) X	0.389		24	F TEMPERATURE DIFFERENCE	В	0.05	MBTU / HR
CORR MTL PNL WALL =	0	AREA (SF) X	0.17	_	54	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
CLR SGL PANE WINDOWS =	1123	AREA (SF) X	1.235	_	54	F TEMPERATURE DIFFERENCE	П	0.07	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE		00.00	MBTU / HR
METAL ROLL UP DOORS =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	П	00.00	MBTU / HR
WOOD GLAZED O'HEAD DR =	1372	AREA (SF) X	0.214		24	F TEMPERATURE DIFFERENCE	II	0.02	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56		54	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	П	0.00	MBTU/HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	R	0.00	MBTU/HR
							ļ		

MBTU / HR MJ/HR

0.26 273.83

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TOTAL ECO HEAT LOSSES

### **ECO - 1: INFRARED HEATING CALCULATIONS**

	BASELINE	ECO - 1
SYSTEM EFFICIENCY	%09	%06
OUTSIDE DESIGN TEMP (F)	-	-
HTG TEMP SETPOINT (F)	09	55
HEATING DEGREE DAYS	4616	3396
TOTAL HEAT LOSSES	900	90
(MBTU / HR)	0.20	0.20
\$ /MBTU -FUEL OIL	\$6.60	\$6.60
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62
A MRTII DDG	\$10 BA	£10 84

<b>BUILDING NUMBER</b>	6562
	GLOSSARY OF TERMS
1 MBTU = 1055 MJ	
0.019=CONSTANT	
.81 = CONSTANT FOR SL	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPI	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FRC	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

	ANNUAL HEATING	TING ENERG	3Y C	ENERGY CONSUMPTION (DEGREE DAY METHOD)	DEGREE	DAY	METHO	(a	
BASELINE =	0.28	MBTU/HR X A	4616 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	HRS/DAY	11	887.50	MBTU/YR	
	887.50	MBTU/YR	×	CORR FACTOR	~	н.		887.50	MBTU/YR
ECO - 1 =	0.26	MBTU/HR X SYS EFF X	3396 54	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	HRS/DAY	II I	435.29	MBTU/YR	
	435.29	MBTU/YR	×	CORR FACTOR	<b></b>	\$1		435.29	MBTUMR
	ECO - 1 ANNU		Š E	AL HEATING ENERGY CONSUMPTION SAVINGS	ON SAVINGS	11 11		452.21 477.080.96	MBTU/YR MJ/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	NERG	Y COST				
BASELINE =	887.50	MBTU/YR X 6.6	6.6	\$ /MBTU	H	= 5,857.50 \$ MR	<b>\$</b> \	
ECO - 1 =	435.29	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,011.04 \$ MR	-\$ ∧R	
	ECO - 1 ANNI	ECO - 1 ANNUAL HEATING ENFRGY COST SAVINGS = 384646 4 MP	NFRGY (	COST SAVINGS	II	3 846 46	₩ W	

	正	T KNOX LIMITED	×	LIMI	red eeap	9	EEAP (GLASS)			
	Щ	ECO - 1: IN	FA	ARED	1: INFRARED HEATING CALCULATIONS	C	ULATIONS			
									PAGE	1 OF 3
BUILDING NUMBER:	6563	1		BUILDING OUTSIDE ( TEMPERA'	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TUR	E SETPOINT: 60	ا الدالدالد		
INFILTRATION LOSSES =	-	AIR CHGS	×	73600	VOL (CUFT) X	59	F TEMP DIFF X 0.019	11	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEA	RF	LINEAR FEET OF PERIMETER	RIMETER X	59	F TEMP DIFF X 0.81	H	0.02	MBTU / HR
SURFACE HEAT LOSSES										
FLAT BUILT UP ROOF =	4800	AREA (SF) X	×	0.105	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	Ħ	0.03	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF)	×	0.176	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	- AREA (SF)	×	0.389	B(F)	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
CORR MTL PNL WALL =		AREA (SF)	×	0.17	U VALUE (BTU/ HR - SF - F) X	29	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
CLR SGL PANE WINDOWS =	1123	AREA (SF)	×	1.235	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	n	0.08	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF)	×	0.65	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =	•	- AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	Ħ	0.00	MBTU / HR
METAL GLAZED O'HEAD DR =	1372	AREA (SF)	×	0.214	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	н	0.02	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF)	×	0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	R	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF)	`×	0.615	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	31.	0.00	MBTU / HR
					TOTAL BASEL	N.	TOTAL BASELINE HEAT LOSSES	11 11	0.28 299.19	MBTU / HR MJ/HR

# ECO - 1: INFRARED HEATING CALCULATIONS

2 OF 3		MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU / HR	MBTU/HR	MBTU / HR	MBTU / HR	MBTU/HR	MBTU/HR	MBTU / HR	
PAGE 2 OF		0.08	0.01	0.03	0.00	0.05	0.00	0.07	• 0.00	0.00	0.02	0.00	0.00	0.00	
<u>·</u>	1 11. 11. 11.	11	n '	II	Ħ	п	11	Ħ	п	R	n	11	Ħ	n	ľ
	RE SETPOINT: 55	F TEMP DIFF X 0.019	F TEMP DIFF X 0.81	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	F TEMPERATURE DIFFERENCE	
	XATURE	54	54 F	54	54	54	54	54	. 54	54	54	54	54	54	
	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	VOL (CUFT) X	PERIMETER X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	U VALUE (BTU/ HR - SF - F) X	
	BUILDING DUTSIDE TEMPER	73600	LINEAR FEET OF F	0.105	0.176	0.389	0.17	1.235	0.65	0.56	0.214	0.56	0.56	0.615	
	<b>2</b> 0 1	×	7 FE	×	×	×	×	×	×	×	×	×	×	×	
		AIR CHGS	LINEAF	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	AREA (SF)	
	6563	-	320	4800	0	2440	0	1123	0	0	1372	0	0	. 52	
	BUILDING NUMBER:	INFILTRATION LOSSES =	FLOOR LOSSES =	SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	FACE BRICK/BLK WALL =	8" CINDER BLOCK WALL =	CORR MTL PNL WALL =	CLR SGL PANE WINDOWS =	TINTED DBL PANE WIN'W =	METAL ROLL UP DOORS =	WOOD GLAZED O'HEAD DR =	LG MTL SLIDING DOOR =	METAL PERSONNEL DR=	MTL/ GLAZED PERSONNEL=	

MBTU / HR MJ/HR

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TOTAL ECO HEAT LOSSES

**ECO - 1: INFRARED HEATING CALCULATIONS** 

,									
	ECO - 1	%06	-	55	3396	0.26	\$6.60	\$4.62	\$10.84
	BASELINE	%09	-	09	4616	0.28	\$6.60	\$4.62	\$10.84
		SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES (MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	A MBTII -PPG

BUILDING NUMBER	8 6563
	GLOSSARY OF TERMS
1 MBTU = 1055 MJ	
0.019=CONSTANT	
.81 = CONSTANT FOR	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EN	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS F	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

	ANNUAL HEA	TING ENERGY	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	EGREE DA	AY METHO	(a	
BASELINE =	0.28	MBTU / HR X 4616	TU / HR X 4616 DEGREE DAYS X 24 HRS/DAY	HRS/DAY			
		SYS EFF X 59	EFF X 59 TEMP DIFFERENCE	!	= 887.50	MBTU/YR	
•	887.50	MBTU/YR X	CORR FACTOR 1		ti	887.50	MBTU/YR
ECO - 1=	0.26	MBTU/HR X 3396	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY	HRS/DAY			
	6.0	SYS EFF X · 54	TEMP DIFFERENCE		= 435.29	MBTUYR	
	435.29	MBTU/YR X	CORR FACTOR 1		II	435.29	MBTU/YR
	ECO -1	ANNUAL HEATNG E	ECO -1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	SAVINGS	H 11	452.21 477,080.96	MBTUMR

	ANNUAI	ANNUAL HEATING ENERGY COST	SNERG	YCOST				
BASELINE =	887.50	MBTU/YR X 6.6	9.6	\$ /MBTU	ì	5,857.50 \$ MR	\$ /YR	
ECO - 1=	435.29	MBTU/YR X 4.62	4.62	\$ /MBTU	H	2,011.04 \$ MR	* WR	
	ECO -1 ANN	ECO -1 ANNUAL HEATING ENERGY COST SAVINGS =	ENERGY	COSTSAVNG	II	3,846.46 \$ MR	\$ MR	

## ECO - 1: INFRARED HEATING CALCULATIONS

									PAGE	PAGE 1 OF 3
BUILDING NUMBER:	6564	1		BUILDING H OUTSIDE DE TEMPERATI	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE		60 F 1 F 59 F		
INFILTRATION LOSSES =		AIR CHGS	×	73600	VOL (CUFT) X	29	F TEMP DIFF X 0.019	11	0.08	MBTU / HR
FLOOR LOSSES =	320	LINEA	БĒ	LINEAR FEET OF PERIMETER	IMETER X	29	F TEMP DIFF X 0.81	Ħ	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	4800	AREA (SF) X	×	0.105	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	II	0.03	MBTU / HR
FACE BRICK/BLK WALL =		AREA (SF)	×	0.176	U VALUE (BTU/ HR - SF - F) X	-69	F TEMPERATURE DIFFERENCE	#1	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	AREA (SF)	×	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
CORR MTL PNL WALL =		AREA (SF)	×	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	н	0.00	MBTU/HR
CLR SGL PANE WINDOWS =	1123	AREA (SF)	×	1.235	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	II	0.08	MBTU/HR
TINTED DBL PANE WIN'W =		AREA (SF)	×	0.65	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	и	0.00	MBTU/HR
METAL ROLL UP DOORS =		AREA (SF)	×	0.56	U VALUE (BTU/ ' HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	. "	0.00	MBTU/HR
METAL GLAZED O'HEAD DR =	1372	AREA (SF)	×	0.214	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.02	MBTU/HR
LG MTL SLIDING DOOR =		AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	×	0.615	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	li	0.00	MBTU/HR
	•							l		

MBTU / HR MJ/HR

0.28 299.19

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**TOTAL BASELINE HEAT LOSSES** 

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# **ECO - 1: INFRARED HEATING CALCULATIONS**

									PAGE 2 OF	2 OF 3
BUILDING NUMBER:	6564			UILDING UTSIDE EMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE SETP JRE	OINT: 55 F	ir ir ir		
INFILTRATION LOSSES =	-	AIR CHGS	×	73600	VOL (CUFT) X 54	4 F TEMP DIFF	NFF X 0.019	11	0.08	MBTU/HR
FLOOR LOSSES =	320	LINEAR	FEE	ET OF PE	LINEAR FEET OF PERIMETER X 5	54 F TEMP DIFF	OFF X 0.81	11	0.01	MBTU / HR
SURFACE HEAT LOSSES										
FLAT BUILT UP ROOF =	4800	AREA (SF)	×	0,105	U VALUE (BTU/ 5 HR - SF - F) X	54 F TEN DIFF	TEMPERATURE DIFFERENCE	н	0.03	MBTU/HR
FACE BRICK/BLK WALL =	0	AREA (SF)	×	0.176	U VALUE (BTU/ 5 HR - SF - F) X	54 F TEN DIFF	TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2440	AREA (SF)	×	0.389	U VALUE (BTU/ 5 HR - SF - F) X	54 F TEN DIFF	TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
CORR MTL PNL WALL =	0	AREA (SF)	×	0.17	U VALUE (BTU/ 5 HR - SF - F) X	54 F TEN DIFF	TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
CLR SGL PANE WINDOWS =	1123	AREA (SF)	×	1.235		54 F TEN DIFF	TEMPERATURE DIFFERENCE	11	.0.07	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF)	×	0.65		54 F TEN DIFF	TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
METAL ROLL UP DOORS =	0	AREA (SF)	×	0.56		54 F TEN DIFF	TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
WOOD GLAZED O'HEAD DR =	1372	AREA (SF)	×	0.214		54 F TEN DIFF	TEMPERATURE DIFFERENCE	п	0.02	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF)	×	0.56		54 F TEN DIFF	TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF)	×	0.56		54 F TEN DIFF	TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF)	×	0.615	U.VALUE (BTU/ HR - SF - F) X	54 F TEN DIFF	TEMPERATURE DIFFERENCE	н	00.0	MBTU / HR
					TOTAL ECO HEAT! OSSES	PATIONS	V	ı	90 0	OH / HEAD
			•				?	1 11	273.83	MJ/HR

**ECO - 1: INFRARED HEATING CALCULATIONS** 

	BASELINE	ECO - 1
SYSTEM EFFICIENCY	%09	%06
OUTSIDE DESIGN TEMP (F)	-	-
HTG TEMP SETPOINT (F)	09	55
HEATING DEGREE DAYS	4616	3396
TOTAL HEAT LOSSES	0.08	80.0
(MBTU / HR)	0.20	0.20
\$ /MBTU -FUEL OIL	\$6.60	\$6.60
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62
\$ /MBTU -PPG	\$10.84	\$10.84

GLOSSARY OF TERMS  1 MBTU = 1055 MJ  0.019=CONSTANT  .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE  CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS  65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	BUILDING NUMBER	6564
1 MBTU = 1055 MJ 0.019=CONSTANT .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2		GLOSSARY OF TERMS
0.019=CONSTANT  .81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE  CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS  65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	1 MBTU = 1055 MJ	
.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	0.019=CONSTANT	
CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS 65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	.81 = CONSTANT FOR SLA	B PERIMETER UNINSULATED FROM ASHRAE
65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	CORR FACTOR = EMPIR	ICAL CORRECTION FACTOR FOR HEATING EFFECT VS
	65 F DEGREE-DAYS FROM	A ASHRAE FUNDAMENTALS 1989 PG28.2

	NOAL HEA		2	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	להה ט	AT ME	100)	
BASELINE =	0.28	MBTU/HR X 46 SYS EFF X	616 59	TU / HR X 4616 DEGREE DAYS X 24 HRS/DAY EFF X 59 TEMP DIFFERENCE	DAY	= 887.50	MBTU/YR	
	887.50	MBTU/YR	×	CORR FACTOR 1		II	887.50	MBTU/YR
ECO - 1 =	0.26	MBTU/HR X 3:	396	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY	JAY			
	0.0	SYS EFF X	24	TEMP DIFFERENCE		= 435.29	MBTUMR	
	435.29	MBTU/YR	×	CORR FACTOR 1		11	435.29	MBTU/YR
	ECO - 1	ANNUAL HEATIN	G EN	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	INGS	11: 1	452.21	MBTU/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	:NERG)	COST				
BASELINE =	887.50	MBTU/YR X 6.6	9.9	\$ /MBTU	11	= 5,857.50 \$ /YR	\$ MR	
ECO - 1 =	435.29	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,011.04 \$ MR	_\$ /YR	
	ECO - 1 ANNI	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 3 846 46 CMB	NFRGY C	OST SAVINGS	11	3 846 46	a ≥	

## ECO - 1: INFRARED HEATING CALCULATIONS

							_	PAGE 1 OF	1 OF 3
BUILDING NUMBER:	6576	I	BUILDING H OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	rure Ire	SETPOINT: 60 F			
INFILTRATION LOSSES =	-	_ AIR CHGS X	4114900	VOL (CUFT) X	59	F TEMP DIFF X 0.019	11	0.13	MBTU / HR
FLOOR LOSSES =	S = 350	LINEAR	LINEAR FEET OF PERIMETER	RIMETER X	59	F TEMP DIFF X 0.81	1 11	0.02	MBTU / HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	0069 = :	AREA (SF) X	۷ 0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.04	MBTU / HR
FACE BRICK/BLK WALL =	".	– AREA (SF) X	4 0.176	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
8" CINDER BLOCK WALL =	. = 2936	AREA (SF) X	× 0.389	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	п	0.07	MBTU / HR
CORR MTL PNL WALL =	.= 1165	AREA(SF) >	X 0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.01	MBTU/HR
CLR SGL PANE WINDOWS =	092 = 3	AREA(SF) >	X 1.235	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	Ħ .	90.0	MBTU/HR
TINTED DBL PANE WIN'W =	= /	AREA(SF) >	X 0.65	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =		AREA (SF)	X 0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERÀTURE DIFFERENCE	II	0.00	MBTU/HR
METAL GLAZED O'HEAD DR =	1344	 AREA (SF) >>	X 0.214	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	#1	0.02	MBTU / HR
LG MTL SLIDING DOOR =	11	AREA (SF)	X 0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
METAL PERSONNEL DR=	=>	AREA (SF)	X 0.56	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	H	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	_= 25	— AREA (SF) ) —	X 0.615	U VALUE (BTU/ HR-SF-F) X	29	F TEMPERATURE DIFFERENCE	п '	0.00	MBTU/HR
				TOTAL BASELINE HEAT LOSSES	Ä.	IEAT LOSSES		0.34 359.33	MBTU / HR MJ/HR

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## **ECO - 1: INFRARED HEATING CALCULATIONS**

		-						PAGE	PAGE 2 OF 3
BUILDING NUMBER:	6576		BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TURE	55	rrir J		
INFILTRATION LOSSES =	<del></del>	AIR CHGS X	114900	VOL (CUFT) X 5	54 FT	F TEMP DIFF X 0.019	11	0.12	MBTU/HR
FLOOR LOSSES=	350	LINEAR FEET OF		PERIMETER X 5	54 FT	F TEMP DIFF X 0.81	11	0.02	MBTU/HR
SURFACE HEAT LOSSES									
FLAT BUILT UP ROOF =	0069	AREA (SF) X	0.105	U VALUE (BTU/ 5 HR - SF - F) X	54 F	F TEMPERATURE DIFFERENCE	ŧı	0.04	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF) X	0.176	U VALUE (BTU/ 5 HR - SF - F) X	54 F	TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389		54	F TEMPERATURE DIFFERENCE	п	90.0	MBTU / HR
CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ 5 HR - SF - F) X	54 F	F TEMPERATURE DIFFERENCE	п	0.01	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235		54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	0.65	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	00.00	MBTU/HR
METAL ROLL UP DOORS =	0	AREA (SF) X	0.56	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	II	00.00	MBTU / HR
WOOD GLAZED O'HEAD DR =	1344	AREA (SF) X	0.214	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	u	0.02	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF) X	0.56	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	П	00.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56	U VALUE (BTU/ 5 HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	Ħ	00.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
				TOTAL ECO HEAT LOSSES	HEAT	LOSSES	11	0.31	MBTU / HR
							H	328.88	MJ/HR

### **ECO - 1: INFRARED HEATING CALCULATIONS**

	BASELINE	ECO - 1	
SYSTEM EFFICIENCY	%09	%06	
OUTSIDE DESIGN TEMP (F)	_	-	
HTG TEMP SETPOINT (F)	09	55	
HEATING DEGREE DAYS	4616	3396	
TOTAL HEAT LOSSES	700	č	
(MBTU / HR)		0.31	
\$ /MBTU -FUEL OIL	\$6.60	\$6.60	
\$ /MBTU -NATURAL GAS	\$4.62	\$4.62	
\$ /MBTU -PPG	\$10.84	\$10.84	

	GLOSSARY OF TERMS			.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2
6576	GLC			3 PERI	CAL CC	<b>ASHR</b>
BUILDING NUMBER		1 MBTU = 1055 MJ	0.019=CONSTANT	.81 = CONSTANT FOR SLAB	CORR FACTOR = EMPIRIC	65 F DEGREE-DAYS FROM

	ANNUAL HEATING	ATING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	(DEGREE	AY METH	(ac		
BASELINE =	0.34	MBTU/HR X 4616 SYS EFF X 59	TU/HR X 4616 DEGREE DAYS X 24 HRS/DAY EFF X 59 TEMP DIFFERENCE	4 HRS/DAY	= 1,065.90	MBTU/YR		
	1,065.90	MBTU/YR X	CORR FACTOR	<b>-</b>		1,065.90	MBTU/YR	
ECO - 1 =	0.31	MBTU/HR X 3396 SYSEFF X 54	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	4 HRS/DAY	= 522.79	MBTU/YR		
	522.79	MBTU/YR X	CORR FACTOR	<del>-</del>	n	522.79	MBTU/YR	
	ECO - 1 ANNU	ANNUAL HEATING	AL HEATING ENERGY CONSUMPTION SAVINGS	ON SAVINGS	11 11	543.11	MBTUMR	

	ANNUAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST				
BASELINE =	1,065.90	MBTU / YR X 6.6	9.9	\$ /MBTU	П	7,034.93 \$ MR	\$ MR	
ECO - 1 11	522.79	MBTU/YR X 4.62	4.62	\$ /MBTU	11	2,415.28 \$ MR	-\$ MR	
	ECO - 1 ANNL	JAL HEATING E	:NERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 4.619.64 \$ /YR	31	4.619.64	S MR	

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## ECO - 1: INFRARED HEATING CALCULATIONS

			,					PAGE 1 OF	1 OF 3
BUILDING NUMBER:	6577	1	BUILDING H OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TUR! JRE	E SETPOINT: 60			
INFILTRATION LOSSES =	-	AIR CHGS X	114900	VOL (CUFT) X	59	F TEMP DIFF X 0.019	11	0.13	MBTU / HR
FLOOR LOSSES =	350	LINEAR	LINEAR FEET OF PERIMETER	NMETER X	59	F TEMP DIFF X 0.81	ti	0.02	MBTU / HR
SURFACE HEAT LOSSES									
FLAT BUILT UP ROOF =	0069	AREA (SF) X	0.105	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.04	MBTU/HR
FACE BRICK/BLK WALL =		AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
8" CINDER BLOCK WALL =	2936	AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.07	MBTU/HR
CORR MTL PNL WALL =	1165	AREA (SF) X	0.17	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	11	0.01	MBTU/HR
CLR SGL PANE WINDOWS =	260	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	90.0	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	30.05	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
METAL ROLL UP DOORS =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	' F TEMPERATURE DIFFERENCE	п	0.00	MBTU/HR
METAL GLAZED O'HEAD DR =	1344	AREA (SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.02	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	H	0.00	MBTU/HR
MTL/ GLAZED PERSONNEL=	25	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	0.00	MBTU/HR
							l		

MBTU / HR MJ/HR

H H

TOTAL BASELINE HEAT LOSSES

# **ECO - 1: INFRARED HEATING CALCULATIONS**

MBTU / HR MJ/HR	0.31	11 11	TOTAL ECO HEAT LOSSES						
MBTU/HR -	0.00	в '	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.615	×	AREA (SF) X	25	MTL/ GLAZED PERSONNEL=	
MBTU / HR	0.00	н	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.56	×	AREA (SF)	0	METAL PERSONNEL DR=	
MBTU / HR	0.00	11	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.56	×	AREA (SF)	0	LG MTL SLIDING DOOR =	
MBTU / HR	0.05	11	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.214	×	AREA (SF)	1344	WOOD GLAZED O'HEAD DR =	
MBTU / HR	0.00	п	U VALUE (BTU/ 54 F TEMPERATURE HR - SF - F) X 54 DIFFERENCE	0.56	×	AREA (SF)	0	METAL ROLL UP DOORS =	
MBTU / HR	0.00	п.	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.65	×	AREA (SF)	0.	TINTED DBL PANE WIN'W =	
MBTU / HR	0.05	Ħ	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	1.235	×	AREA (SF)	160	CLR SGL PANE WINDOWS =	
MBTU / HR	0.01	11	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.17	×	AREA (SF)	1165	CORR MTL PNL WALL =	
MBTU / HR	90.0	Ħ	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.389	×	AREA (SF)	2936	8" CINDER BLOCK WALL =	
MBTU / HR	0.00	п	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.176	×	AREA (SF)	0	FACE BRICK/BLK WALL =	
MBTU / HR	0.04	11	U VALUE (BTU/ 54 F TEMPERATURE HR-SF-F) X 54 DIFFERENCE	0.105	×	AREA (SF)	0069	FLAT BUILT UP ROOF =	
_ MBTU / HR	0.02	11	SIMETER X 54 F TEMP DIFF X 0.81	LINEAR FEET OF PERIMETER	E C	LINEA	350	FLOOR LOSSES =	
_ MBTU / HR	0.12	ıı '	VOL (CUFT) X 54 F TEMP DIFF X 0.019	114900	×	AIR CHGS X	<del></del>	INFILTRATION LOSSES =	
			BUILDING HEATING TEMPERATURE SETPOINT: 55 F OUTSIDE DESIGN TEMPERATURE 1 F TEMPERATURE DIFFERENCE 54 F	BUILDING HOUTSIDE D			6577	BUILDING NUMBER:	
PAGE 2 OF 3	PAGE								

### **ECO - 1: INFRARED HEATING CALCULATIONS**

ECO - 1	%06	<b>-</b>	55	3396	0.31	\$6.60	\$4.62	\$10.84
BASELINE	%09	-	09	4616	0.34	\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MBTU -PPG

BUILDING NUMBER	6577
	GLOSSARY OF TERMS
1 MBTU = 1055 MJ	
0.019=CONSTANT	
.81 = CONSTANT FOR SL	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE
CORR FACTOR = EMPIR	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS
65 F DEGREE-DAYS FRO	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

Af	ANNUAL HEATING	TING ENER	3Y C	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	DAY	METHO	(c	
BASELINE =	0.34	MBTU/HR X SYS EFF X	4616 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	11	1,065.90	MBTU/YR	
	1,065.90	MBTU/YR	×	CORR FACTOR 1	11		1,065.90	MBTU/YR
ECO - 1 =	0.31	MBTU/HR X SYS EFF X	3396 54	MBTU / HR X 3396 DEGREE DAYS X 24 HRS/DAY SYS EFF X 54 TEMP DIFFERENCE	n	522.79	MBTU/YR	
	522.79	MBTU/YR	×	CORR FACTOR 1	11	ı	522.79	MBTU/YR
	ECO - 1	ANNUAL HEATII	NG EI	ECO - 1 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	11 11		543.11 572,980.27	MBTU/YR MJ/YR

	ANNUAL	ANNUAL HEATING ENERGY COST	ENERG	Y COST				
BASELINE =	1,065.90	MBTU/YR X 6.6	9.9	\$ /MBTU	Ħ	= 7,034.93 \$ /YR	\$ MR	
ECO - 1 =	522.79	MBTU/YR X 4.62	4.62	\$ /MBTU	11	= 2,415.28 \$ /YR	\$ MR	
	ECO - 1 ANNL	JAL HEATING E	NERGY	ECO - 1 ANNUAL HEATING ENERGY COST SAVINGS = 4,619.64 \$ /YR	ŧi	4,619.64	<b>\$</b>	

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: 6592EC01
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

LCCID 1.080

INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: 6592ECO1 ECO-1 INFRARED HEAT
FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED
ANALYSIS DATE: 10-18-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH

- 1. INVESTMENT
- A. CONSTRUCTION COST \$ 34056.
  B. SIOH \$ 1703.
  C. DESIGN COST \$ 1703.
  D. TOTAL COST (1A+1B+1C) \$ 37462.

- E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ Ο. 0.
- F. PUBLIC UTILITY COMPANY REBATE \$
- G. TOTAL INVESTMENT (1D 1E 1F) 37462.
- 2. ENERGY SAVINGS (+) / COST (-)

DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993

FUE	EL		IT COST MBTU(1)	SAVINGS MBTU/YR(2)		WAL \$ 'INGS (3)	DISCOUNT FACTOR (4)		COUNTED INGS (5)
B. C. D. E.	ELECT DIST RESID NAT G COAL LPG DEMANI	<b>លលលលល</b>	.00 6.60 .00 4.62 .00 .00	0. 0. 0. 671. 0.	<i>~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~</i>	0. 0. 0. 3100. 0.	15.61 17.56 19.97 20.96 17.58 16.12 14.74	ስማማማማሳሳ	0. 0. 0. 64973. 0.
N.	TOTAL	ي ر	AVINGS	671.	\$	3100.	<u></u>	\$	64973.

- 3. NON ENERGY SAVINGS(+) / COST(-)
  - A. ANNUAL RECURRING (+/-)
    - 990. (1) DISCOUNT FACTOR (TABLE A) 14.74

    - (2) DISCOUNTED SAVING/COST (3A X 3A1) \$ 14593.
  - B. NON RECURRING SAVINGS (+) / COSTS (-)

		SA	VINGS(+)	YR	DISCNT	DISCOUNTED
	ITEM		COST(-)	OC	FACTR	SAVINGS(+)/
			(1)	(2)	(3)	COST(-)(4)
1.	REPAIR	\$	3992.	5	.86	3433.
2.	REPAIR2	\$	3992.	15	.63	2515.
3.	REPAIR3	\$	3211.	7	.81	2601.
4.	REPAIR4	\$	3211.	14	.65	2087.
	moma r					
a.	TOTAL	Ş	14407.	•		10637.

- C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$
- 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$
- 5. SIMPLE PAYBACK PERIOD (1G/4)

- 7.79 YEARS
- 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 90202.
- (SIR) = (6 / 1G) =7. SAVINGS TO INVESTMENT RATIO 2.41 (IF < 1 PROJECT DOES NOT QUALIFY)
- 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 7.73 %

U02 SITEWORK

104

\$109

\$2,545

\$507

BLDG 6592 Date: 14-Oct-94 Estimate: COST ESTIMATE Description: LIMITED EEAP (GLASSBID Date: Project: FORT KNOX, KY Job #: 94013.02 Location: 8100.00 City indx:Louisville, KY Sq. footage: Description Line # Equipment Manhours Matl \_\_\_\_\_\_\_ SITE REMOVAL, STEEL PIPE, WELDED CONNECTION, 0205543200 300.00 L.F. 4"DIAMETER 0.15 0.00 3.16 1.29 Unit values 0.00 4.44 Totals 45.00 \$0 \$947 \$386 \$0 \$1,333 0207180380 HVAC DEMO, BOILER GAS/OIL STL >150MBH 1.00 Ea. Unit values 12.00 0.00 323.82 0.00 0.00 323.82 Totals \$0 12.00 \$0 \$324 \$0 \$324 0207183600 HVAC DEMO, MECH EOPT HEAVY ITEM 0.50 Ton 0.00 Unit values 380.36 0.00 14.55 0.00 380.36 Totals 7.27 \$0 \$190 \$0 \$0 \$190 REMOVE PIPE INSULATION UP TO 4" DIAMETER PIPE 0208400600 300.00 L.F. 0.07 0.24 Unit values 0.00 1.97 0.00 2.21 \$592 \$71 Totals 21.30 \$0 \$0 \$663 REMOVE INSULATION FROM PIPE FITTING, UP TO 4" 0208401000 DIAMETER PIPE 60.00 Ea. Unit values 0.20 0.00 5.55 0.68 0.00 6.23 Totals 12.00 \$0 \$333 \$41 \$0 \$374 0268520600 GAS SERVICE&DISTRIB PIPING, SCH40 STEEL PLAIN END, TAR COAT&WRAP 2"DIAM 50.00 L.F. Unit values 0.11 2.19 3.18 0.19 0.00 5.55 Totals 5.70 \$109 \$159 \$9 \$0 \$277

\$0

\$3,161

Line #	Description					
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================	=========					
				/ 0 7 4 4 -		
1554510245	HTG INFA-RD	UNT GAS	ELEC IGN	(See Atta	iched for 1.00	Breakdown)
Unit values	0.00	0.00	0.00		25219.00	25219.00
Totals	0.00	\$0	\$0	\$0	\$25,219	\$25,219
U15 MECHANICAL	0	\$0	\$0	\$0	\$25,219	\$25,219

Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
ESTIMATE TOTAL	104	\$109	\$2,545	\$507	\$25,219	\$28,380
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$109	\$2,545	\$507	\$25,219	\$28,380 \$2,838 \$0 \$2,838
JOB TOTAL						\$34,056

\_\_\_\_\_\_\_\_\_\_\_ Date: 14-Oct-94

Estimate: BLDG 6592
Description: COST ESTIMATE

Project:

LIMITED EEAP(GLASSBid Date: FORT KNOX, KY Job #:

94013.02

Location: Sq. footage: 8100.00

City indx:Louisville, KY

SUMMARY

	50	JIMIMAK I				
	Manhours	Matl	Labor	Equipment	Sub	Total
==========	=========					
U02 SITEWORK U15 MECHANICAL	104	\$109 \$0	\$2,545 \$0	\$507 \$0	\$0 \$25,219	\$3,161 \$25,219
TOTAL	104	\$109	\$2,545	\$507	\$25,219	\$28,380
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	\$0	\$0	; \$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$109	\$2,545	. \$507	\$25,219	\$28,380 \$2,838 \$0 \$2,838
JOB TOTAL						\$34,056

\_\_\_\_\_\_ Estimate: BLDG 6592 Date: 14-Oct-94 Description: INFRARED HEATING SYSTEM COST ESTIMATE Project: LIMITED EEAP(GLASSBID Date: FORT KNOX, KY Job #: 94013.02 Location: City indx:Louisville, KY Sg. footage: Description Line # Manhours Matl Labor Equipment Sub Total \_\_\_\_\_\_ 115V, 20 AMP POWER WIRING INCL CONDUIT, WIRE, 0913100200 AND RECEPTACLES 340.00 L.F. 4.57 0.15 2.22 0.00 6.79 Unit values 0.00 Totals 50.66 \$753 \$1,555 \$0 \$0 \$2,308 0913100200 CO-RAY-VAC VANTAGE 2 POWER FEEDER INSTALLATION, INCL CONDUIT, WIRE, AND RECEPTACLES 120.00 L.F. Unit values 0.15 2.22 4.57 0.00 0.00 6.79 Totals 17.88 \$266 \$549 \$0 \$0 \$815 A09 ELECTRICAL 69 \$1,019 \$2,104

\$0

\$0 \$3,123

			======			
Line #	Description	on 				
				Equipment		
=======================================		=======		=======================================	=======	
1517010650	W/CPLGS			SCHEDULE 40,	330.00	L.F.
Unit values Totals	0.44 $146.52$	4.17 \$1,376	10.3 \$3,40	0.00		14.47 \$4,776
1517011310	GAS SERVIO	CE PIPE ST	EEL GAL	V SCH 40 THR	D W/CPLG	& HNGR SZD L.F.
Unit values	0.13	1.64	2.8	8 0.00 4 \$0	0.00	4.52
Totals	57.15	\$738				\$2,032
1519010320	ALUMINUM F	REFLECTORS	W/HANG	ERS 0 0.00 1 \$0	45.00	Ea
Unit values		39.79	3.8	0.00	0.00	43.59
Totals	22.50	\$1,791	ŞI7.	1 \$0	\$0	\$1,962
1524105040		IP AND VEN			1.00	Ea.
Unit values Totals	3.00 3.00	738.35 \$738	120.1 \$12	5 . 0.00	0.00	858.50
1552301020	CRV-100 GA	S FIRED B	URNER,	100 MBH & C	OMBUSTION 6.00	
Unit values Totals	1.00	860.00 \$5,160	44.00 \$264	0.00 4 \$0	0.00	904.06 \$5,424
1554510160	CO-RAY-VAC	VANTAGE	2 INFA	-RD HTG UNT,	GAS 100M	
Unit values Totals	6.00 6.00	1065.00 \$1,065	163.40 \$163	0.00 3 \$0	0.00	1228.40 \$1,228
1554510220	CO-RAY-VAC	VANTAGE :	2 INFA-I	RD HTG UNIT,	GAS 40 M	
Unit values Totals	4.00 16.00	935.00 \$3,740	81.70 \$327	0.00 7 \$0	0.00	1016.70
1556800120	CO-RAY-VAC	VANTAGE 2	2 VENT I	PIPE	F 00	F
Unit values Totals	1.60	70.00 \$350	76.50 \$382		5.00 0.00 \$0	146.50 \$732
1574205220	ELECTRIC T	HERMOSTAT	W/ COVE	ER AND WIRIN		
Unit values Totals	1.00 6.00	75.00 \$450	27.55 \$165		6.00 0.00 \$0	Ea. 102.55 \$615

	-======					
Line #	Descript	ion				
	Manhours	Matl	Labor	Equipment	Sub	Total
=======================================						
U15 MECHANICAL	272	\$15,408	\$6,286	\$0	\$0	\$21,694
1631200100	HEATING	SYSTEM POWER	conti	ROL PANEL	1.00	Ea.
Unit values Totals	2.96 2.96	330.76 \$331	70.58 \$71	0.00 \$0	0.00	401.34 \$402
U16 ELECTRICAL	3	\$331	\$71	\$0	\$0	\$402

					========	
Line #	Descripti	on		•		
	Manhours	Matl	Labor	Equipment	Sub	Total
ESTIMATE TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
SALES TAX MATL MARKUP	0.00%	\$0 \$0				
LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00%		\$0	\$0	\$0	
TOTAL BEFORE COCONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0
JOB TOTAL						\$25.219

\_\_\_\_\_\_

Estimate: BLDG 6592 Date: 14-Oct-94 INFRARED HEATING SYSTEM COST ESTIMATE

Description: Project:

LIMITED EEAP(GLASSBid Date: FORT KNOX, KY

Location: Sq. footage: Job #: 94013.02 City indx:Louisville, KY

•	S	UMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
	=======	=======			=======================================	========
A09 ELECTRICAL U15 MECHANICAL U16 ELECTRICAL	272	\$1,019 \$15,408 \$331	\$2,104 \$6,286 \$71	\$0 \$0 \$0	\$0 \$0 \$0	\$3,123 \$21,694 \$402
TOTAL	344	\$16,758	\$8,461	\$0	\$0	\$25,219
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00%		,	\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 0.00% 0.00% 0.00%	\$16,758	\$8,461	\$0	\$0	\$25,219 \$0 \$0 \$0
JOB TOTAL						\$25,219

# ECO - 1: INFRARED HEATING CALCULATIONS

								PAGE	PAGE 1 OF 3
BUILDING NUMBER:	6592		BUILDING HOUTSIDE D	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	TUR	E SETPOINT: 60 F	LLLL		
INFILTRATION LOSSES =	-	AIR CHGS X	138900	VOL (CUFT) X	59	F TEMP DIFF X 0.019	11	0.16	MBTU / HR
FLOOR LOSSES =	390	LINEAR	LINEAR FEET OF PERIMETER	IMETER X	59	F TEMP DIFF X 0.81	11	0.02	MBTU/HR
SURFACE HEAT LOSSES FLAT BUILT UP ROOF =	8100	AREA (SF) X	0.105	U VALUE (BTU/	59	F TEMPERATURE	п	0.05	MBTU / HR
FACE BRICK/BLK WALL =		- AREA (SF) X	0.176	U VALUE (BTU/ HR - SF - F) X	59	DIFFERENCE  F TEMPERATURE  DIFFERENCE	H	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	- AREA (SF) X	0.389	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	Ħ	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	- AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	R	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	Ħ	90.0	MBTU / HR
TINTED DBL PANE WIN'W =		AREA (SF) X	. 0.65	U VALUE (BTU/ HR-SF-F) X	59	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	0.56	U VÄLUE (BTU/ • HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	11	90.0	MBTU/HR
METAL GLAZED O'HEAD DR =		_AREA(SF) X	0.214	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	n	00.00	MBTU / HR
. LG MTL SLIDING DOOR =		- AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	R	0.00	MBTU / HR
METAL PERSONNEL DR=		_ AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	п	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	50	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	59	F TEMPERATURE DIFFERENCE	Ħ	00.00	MBTU / HR
		1							

MBTU / HR MJ/HR

0.42

11 11

TOTAL BASELINE HEAT LOSSES

		r KNO)		IMIT	FT KNOX LIMITED EEAP (GLASS)	9	SLASS)			
	ECO		RA	RED !	1: INFRARED HEATING CALCULATIONS	$\overline{C}$	ULATIONS			
		-		·					PAGE	PAGE 2 OF 3
BUILDING NUMBER:	6592			SUILDING SUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUI TURE	E SETPOINT: 55	ir ir ir J	,	
INFILTRATION LOSSES =	· ·	AIR CHGS	×	138900	VOL (CUFT) X	54 F	54 F TEMP DIFF X 0.019	11	0.14	MBTU / HR
FLOOR LOSSES =	390	LINEAF	FE	ET OF PE	LINEAR FEET OF PERIMETER X	54 F	F TEMP DIFF X 0.81	11	0.02	MBTU / HR
SURFACE HEAT LOSSES										
FLAT BUILT UP ROOF =	8100	AREA (SF)	×	0.105	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
FACE BRICK/BLK WALL =	0	AREA (SF)	×	0.176	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
8" CINDER BLOCK WALL =	2743	AREA (SF)	×	0.389	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	90.0	MBTU / HR
CORR MTL PNL WALL =	1685	AREA (SF)	×	0.17	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.02	MBTU / HR
CLR SGL PANE WINDOWS =	760	AREA (SF) · X	×	1.235	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	н	0.05	MBTU / HR
TINTED DBL PANE WIN'W =	0	AREA (SF) X	×.	0.65	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
METAL ROLL UP DOORS =	1792	AREA (SF) X	×	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.05	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF)	×	0.214	U VALUE (BTU/ HR-SF-F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR =	0	AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	u	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF)	×	0.56	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
MTL/ GLAZED PERSONNEL=	20	AREA (SF) X	×.	0.615	U VALUE (BTU/ HR - SF - F) X	54	F TEMPERATURE DIFFERENCE	ti .	0.00	MBTU / HR

MBTU / HR MJ/HR

0.39 406.30

11 11

TOTAL ECO HEAT LOSSES

## ECO - 1: INFRARED HEATING CALCULATIONS

PAGE 3 OF 3

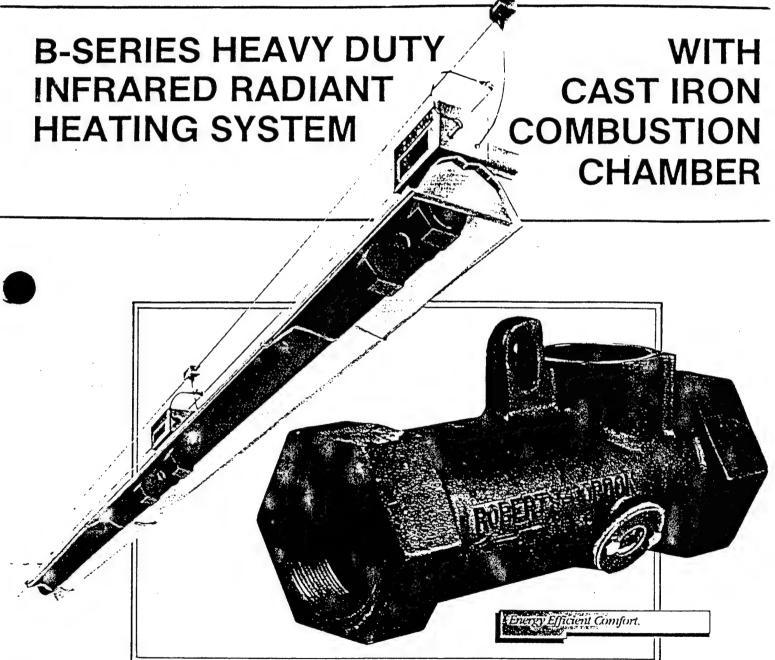
	,								
ECO - 1	%06	_	55	3396		0.39	\$6.60	\$4.62	\$10.84
BASELINE	%09	-	09	4616		0.42	\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	(MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MBTU -PPG

	ANNUAL HEATING	ATING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	DAY METHO	(00	
BASELINE =	0.42	MBTU/HR X 4616 SYS EFF X 59	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 59 TEMP DIFFERENCE	= 1,316.82	MBTU/YR	
	1,316.82	MBTU/YR X	CORR FACTOR 1	11	1,316.82	MBTU/YR
ECO - 1 =	0.39	MBTU/HR X 3396	MBTU/HR X 3396 DEGREE DAYS X 24 HRS/DAY			
	B.O	SYS EFF X . 54	EFF X . 54 TEMP DIFFERENCE	= 645.86	MBTU/YR	
	645.86	MBTU/YR X	CORR FACTOR 1	11	645.86	MBTU/YR
	ECO - 1 ANNU	ANNUAL HEATING E	AL HEATING ENERGY CONSUMPTION SAVINGS	11 (	670.96	MBTU/YR
				11	/07,867.19	MJ/YR

BASELINE = 1,316.82 MBTU/YR X 4.62 \$/MBTU = 6,083.73 \$/YR  .  ECO-1 = 645.86 MBTU/YR X 4.62 \$/MBTU = 2,983.87 \$/YR		ANNOAL	MINIORE CIENTING ENERGY COST	בואנושפ	1 COS 1			
1 = 645.86 MBTU / YR X 4.62 \$ //MBTU	BASELINE =	1,316.82	MBTU/YR X	4.62	\$ /MBTU	11	6,083.73	\$ MR
	<del>-</del>	645.86	MBTU/YR X	4.62	\$ /MBTU	В	2,983.87	\$ MR

### CO-RAY-VAC





CO-RAY-VAC "Classic" B-Series Heavy Duty Systems Feature Cast Iron Combustion Chambers, Burners, Vacuum Pump Housing & Schedule 40 Pipe to Combine "Built Like They Used To" Durability with the Latest in Modern Gas Combustion Technology.

PAGE 5-296



### Everyone Says, "They Don't Build Them Like They Used To..."

Since CO-RAY-VAC infrared heating systems were first installed back in the early 1960's, satisfied customers around the country have enjoyed years of trouble-

free operation with our heavy duty cast iron heating systems. Everyone says, "They don't build them like they used to,"...But Roberts-Gordon does. CO-RAY-VAC heavy duty systems are still available today. They feature all the modern

k in the early 1960's, satisthe country have enjoyed chamber the Country have enjoyed ...But

Roberts-Gordon

improvements, but keep the original cast iron combustion chamber, burners and vacuum

pump housing for rugged durability and top performance year after year. Offered exclusively by Roberts-Gordon, the CO-RAY-VAC "Classic" heavy duty series is especially suited for installations where an extended lifetime of trouble-free service is desired.

 Roberts-Gordon cast iron combustion chambers and vacuum pump housing are warranteed for 15 years against manufacturing defects and defects in workmanship.

### CO-RAY-VAC Gas-Fired, Fully Vented, Low-Intensity Radiant Heating System

Does!





### How Infrared Heating Works

High-efficiency CO-RAY-VAC heating systems warm the workplace in the same manner as the sun heats the earth. Like the sun, CO-RAY-VAC produces infrared rays. These low-intensity rays are directed downward by specially designed reflectors to spread a draftless lanket of warmth that heats the floor, people and jects directly. The warm floor and objects then release heat to warm the air. Since solid objects, not the air, are heated directly, people are comfortable at lower building thermostat settings.

### Outstanding Efficiency, Comfort and Savings

Design-Certified by the American Gas Association.

Outstanding Energy Efficiency—Independently tested Annual Fuel Utilization (AFUE) rating of 90.43%.

Fuel Cost Savings — Customers document savings up to 50% and more on their annual heating costs.

Low Maintenance — Cast iron combustion chambers, burners & vacuum pump housings are especially designed for trouble-free service.

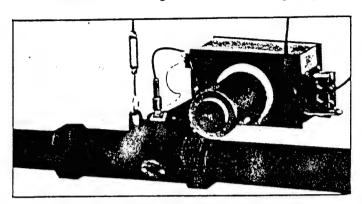
Clean, Quiet, Draft-Free, Uniform Heat—CO-RAY-VAC spreads heat evenly over large areas without noise, drafts or blasts of hot air. No swirling dust or grit, and no interference with your operations.

Greater Worker Comfort & Productivity — Because of the principle of CO-RAY-VAC infrared heating, employees are more comfortable in more favorable conditions. This can boost morale and productivity!

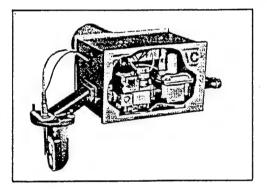
Faster Heat Recovery — Floor and objects act as heat reservoirs, giving off heat and providing fast heat recovery when large doors are closed.

### These are the features of the CO-RAY-VAC Heavy Duty Systems...

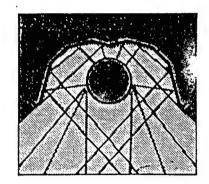
 Burners in series; wide range of inputs from 20,000 to 120,000 BTU for high and low mounting heights.



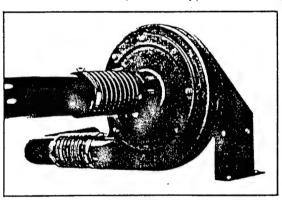
 Heavy duty cast iron combustion chamber for durability and long life.



Cast iron burner and modern direct spark electronic ignition systems eliminate standing pilots and are compatible with state-of-the-art temperature control systems.



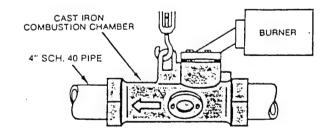
 Deep dish reflectors and perimeter reflectors maximize radiant output in all types of buildings.



- Totally enclosed vacuum pump motor for superior, trouble-free operation even in the most severe building environments.
- Can be suspended up to 60 ft. or more from the floor to clear gantry cranes, high rising equipment, etc.
- · Fully vented, uses natural or propane gas.

### CO-RAY-VAC Heavy Duty Systems

Similar to standard CO-RAY-VAC system, but standard steel combustion chamber and standard radiant tube replaced with cast iron combustion chamber and schedule 40 steel radiant pipe.



		SPE	CIFICATIO	NS .		
MODEL	CRV-B2	CRV-B4	CRV-B6	CRV-B8	CRV-B10	CRV-B12
GAS INPUT BTU/HR.	20,000	40,000	60,000	80,000	100,000	- 120,000 ···.
CLE	ARANCES T	O COMBUS	TIBLES WIT	H STANDAR	D REFLECT	OR
ABOVE	4"	4"	4"	4"	4"	4"
BELOW	48"	48"	48"	48"	60"	60"
SIDE	20"	20"	20"	20"	36"	36"

PAGE 5-298

### ere are just a few installat Heavy Duty Cast Iron

### Marplex Products Co., Inc.

June 9, 1987

Wisconsin Instument & Control, Inc. 3196 N. Main Street Oshkosh, WI 54901

Dear Mr. Steineke:

It is interesting to discover that Marplex's Co-Ray-Vac heating system was the first installation in Wisconsin and also one of the first in the country.

I am pleased to advise you that our system works very well even after 25 years. Our maintenance is minimal and we are looking forward to the next quarter century of operation.

sincerely,

MARPLEX PRODUCTS CO., INC.

James L. Sweet V-Pres. & Gen. Mgr.

Rhinelander, Wisconsin 54501. (716) 362-3193

Breach Mold & Tool New Albany, IN

Brennan Marine Bay City, MI

Clover Park Technical School Tacoma, WA

Dakota Block Company Rapid City, SD

**Daytonna Country Club** Dayton, MN

Hass Cabinet Company Sellersburg, IN

La Choy Food Products Archbold, OH

Lang Manufacturing Redmond, WA

### Chambers have provided dependable service for

15 years

or more.

Rail's Autobody Repair Belle Fourche, SD

Rice County Highway Department Fairbault, MN

Robinson Welding Livonia, MI

Sauder Woodworking Company Archbold, OH

Scott Electric Greensburg, PA

Stoddard Aero Service Anchorage, AK

**Tower Tool Company** Fraser, MI

White Castle Systems Carteret, NJ

William Britland Auto Body, Inc. Green Brook, NJ



### CO-RAY-VAC

Roberts-Gordon, Inc.

Subsidary of A.J. Industries Inc. 1250 William Street . P.O. Box 44 . Buffalo, NY 14240 Phone: (716) 852-4400 • FAX: (716) 852-0854

CALL TOLL FREE: 1-800-828-7450 IN NEW YORK STATE: 1-800-221-0955



RODNEY WILL, INC.

Manufacturers' Representative 2104 NORTHFIELD DRIVE LOUISVILLE, KENTUCKY 40222 PHONE 502 425-3561

FAX 502 425-304@E 5-299



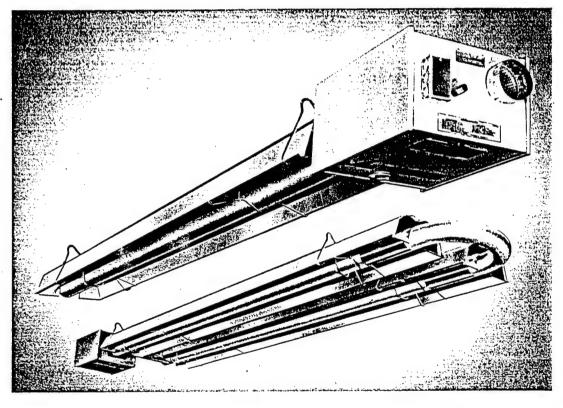
### Cost-Saving, Low-Intensity Infrared Unitary Heaters

RODNEY WILL, INC

2104 NORTHFIELD DRIVE
LOUISVILLE, KENTUCKY 40222

PHONE 502 425-3561

FAX 502 425-3012



### Roberts-Gordon, Inc.

Energy Efficient Comfort.

### VANTAGE II Unitary Heaters Lower Fuel Costs and Raise Comfort Levels.

### **Demonstrated Savings**

Modern gas combustion technology combined with the principles of infrared energy enable VANTAGE II heaters to reduce fuel costs substantially while improving comfort conditions. Users report heating bills cut by up to 50% or more!

### Low Cost...Easy to Install and Maintain

The VANTAGE II models are low-cost, field-assembled infrared heaters that are easy to install and require only minimal maintenance. They are designed to provide years of economical operation and trouble-free service.

### Versatility

VANTAGE II heaters can be installed separately or in combination to fit any floor plan. Straight, L- and U-tube configurations are available. Tube lengths are offered from 10 through 60 feet. Ideal for large areas as well as hard-to-heat spaces!

### Reliability and Expertise

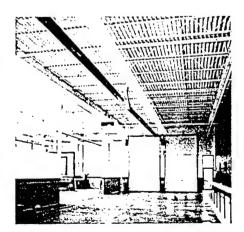
Roberts-Gordon pioneered low-intensity infrared heating systems in 1962 and manufactures the broadest line of low-intensity heating equipment in North America. Backed by a limited three-year warranty, each VANTAGE II unitary heater is built to uphold the well-established Roberts-Gordon standards of engineering excellence, efficiency and reliability.

### **Applications Include:**

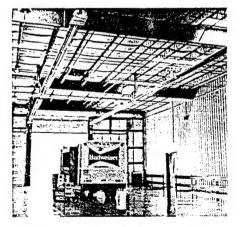
- Automotive Facilities
- Watehouses
- Manufacturing Facilities
- Fire Stations
  - Agricultural BuildingsRecreational Facilities
- Machine Shops
- Aircraft Hangars
- Vehicle Maintenance Buildings



Clean, quiet, draft-free Vantage radiant heat is ideal for automotive service facilities. Unlike forced-air unit heaters, Vantage does not spread dirt, grit or dust.



Vantage unitary heaters are available in a variety of lengths, shapes and configurations to fit any floor plan. Two straight-tube models are shown above in a car dealership.



Floors are kept warm by Vantage infrared energy and act as heat reservoirs to provide rapid heat recovery after bay doors are closed in this warehouse/ shipping area.

### Features:

- Extensive use of corrosion-resistant materials.
- Weight-saving construction to ease installation.
- Forced draft design eliminates the need for a heat-siphoning draft hood.
- 10 through 60 foot tube lengths.
- Clean, quiet, draft-free heat.
- Three-year limited warranty on all components.
- A.G.A. design certified.

"The VANTAGE II heater utilizes design concepts and engineering principles proven by more than 25 years of infrared heating experience."

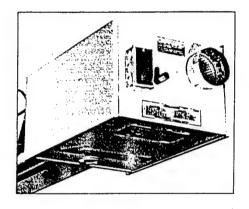
Roberts-Gordon, Inc., Buffalo, New York,

### **Burner Box:**

- 40,000; 60,000; 80,000; 100,000; 125,000 and 150,000 BTU/Hr. models available.
- Natural gas and L.P. models available.
- Moisture-resistant design.
- Nickel plated steel burner cup.
- Outside air adapter standard.
- Hot surface ignition.
- Three-try ignition module.
- Door interlock safety switch.
- All components easily accessed.
- Electrostatically applied paint.
- Durable spot welded construction.
- · Mica flame observation window.
- · Balanced air rotor.
- Stainless steel flex gas line and high pressure gas cock included.

### Tube and Reflector:

- 4" diameter 16-gauge tubing.
- · Quick assembly couplings.
- Deep-dish aluminum reflectors maximize energy reflection, beaming virtually all of the radiant heat downward.
- Reflectors can be tilted 45° to direct heat where needed.
- Entire U-tube heater also can be tilted 45°.
- · End caps included.
- · Nickel plated hangers.
- Chrome plated hardware.
- · Flue connector included.
- 180° U-package option.
- 90° L-package option.
- Decorative grille option.
- Side reflector option.





### Architectural/Engineering Short Form Specifications VANTAGE II CTH2 Series

Gas-lifed, vented, intrared heaters shall be furnished an	d installed i	in accordance	with governing	codes and as	s shown pei	r buildina
drawing(s) as described below.			3 3			3
Heaters shall be VANTAGE II model number CTH2.				DTITUE -	or manufac	turad by

Heaters shall be equipped with a direct sense silicon-carbide hot surface ignition control system with 100% shut-off ignition device. Power supplied to each heater shall be 120V, 60Hz, 10. Heater to be equipped with totally enclosed motor with thermal overload motor protection, balanced air rotor, combustion air proving safety pressure switch, nickel plated burner cup, combustion chamber equipped with sight glass for visual inspection of igniter element and burner flame. Air intake collar standard. Radiant tube assembly to be 4" diameter, aluminized steel first 10 feet. Hot rolled steel remainder of unit. (Or at customer option, aluminized steel for entire tube length.) Reflector to be of aluminum material and designed to direct all radiant output below horizontal centerline of radiant tube. Heaters shall be vented in accordance with manufacturer's recommendations as approved by A.G.A. and ANSI Z-223.1 National Fuel Gas Code. Heaters shall be so designed to operate without requiring heater modifications or adjustments on \_\_\_\_\_\_\_ gas having a net heating value of \_\_\_\_\_\_\_ BTU per cubic foot and a specific gravity of \_\_\_\_\_\_\_

Heaters shall be Design Certified by the American Gas Association (A.G.A.). Supplier shall provide a manufacturer's written varranty covering all components for a period of three (3) years.

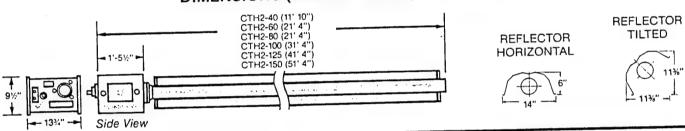


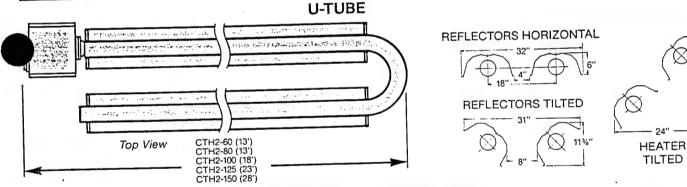
4						the state of the state of the state of the state of
	FLUE	GAS	ELECTRICAL RATING	TUBE DIAMETER		MIN. GAS
	4" (O.D.)	1/2" NPT	120VAC, 60Hz. 1.0 amp run 5.0 amp start	4"	Hot surface (Three-try)	Nat. 4.6" W.C. L.P. 11.0" W.C.

MODEL	BTU/Hr. (Natural Gas or L.P.)	SHIPPING WEIGHT
CTH2-40	40,000	95 lbs.
CTH2-60	60,000	130 lbs.
CTH2-80	80,000	130 lbs.

MODEL	BTU/Hr. (Natural Gas or L.P.)	SHIPPING WEIGHT
CTH2-100	100,000	165 lbs.
CTH2-125	125,000	200 lbs.
CTH2-150	150,000	235 lbs.

### **DIMENSIONS (Standard Models) STRAIGHT**





### CLEARANCES TO COMBUSTIBLES\*

and a Charles			CTH2-40		in t	CTH2-6	0	W.	CTH2-8	0	1	CTH2-10	00		CTH2-12	25 0-5		CTH2-15	50
Configuration	Reflector	Тор	Below	Side	Тор	Below	Side	Тор	Below	Side	Тор	Below	Side	Тор	Below	Side	Тор	Below	
Straight	Horizontal	4"	50"	22"	4"	60"	30"	4"	63"	33"	4"	68"	35"	4"	74"	41"	4"	77"	45"
Straight	Tilted	4"	45"	4"/42"	4"	54"	4"/50"	4"	60"	4"/56"	6"	68"	4"/60"	6"	72"	4"/65"	8"	-78"	4"/70"
U-Tube	Horizontal		_	_	4"	60"	25"/30"	4"	66"	32"/33"	4"	73"	34"/35"	4"	76"	38"/41"	4"	81"	42"/45"
	Tilted		_	-	4"	54"	18"/50"	4"	60"	18"/56"	6"	68"	18"/60"	6"	72"	18"/66"	8"	78"	18"/70"
U-Tube .	a Titted								1			4							

			Below	Side	Ton	Relow	Side	Top	Below	Side	Тор	Below	Side	Тор	Below	Side	Тор	Below	Side
Configuration	Heater	Тор	Below	Side	105			411	1	4"/42"			4"/48"	4"	72"	4"/57"	4"	78"	4"/62"
11-Tube	Tilted	_		-	4"	54"	4"/38"	4	00	4 /42									

<sup>\*</sup>See installation manual for complete information.



### Roberts-Gordon, Inc.

P.O. Box 44 • Buffalo, NY 14240-0044 Phone: (716) 852-4400 • Fax: (716) 852-0854



CALL TOLL FREE: 1-800-828-7450 IN NEW YORK: 1-800-221-0955

### 6 FEMP PROJECT 5: WINDOW INSULATION AT TWO BUILDINGS

FY94 LIMITED ENERGY STUDY (GLASS), FT. KNOX, KY

This section includes FEMP project packet for FEMP Project 5: Window Insulation at two buildings. Following this table of contents is a project summary table, the life cycle cost analysis for this project, and the life cycle cost analysis, cost estimates, and calculations for each building/area included in this project. Below is a detailed index of the information included in this section.

Table FEMI																																								
<u>Buildi</u>	ing	<u>s</u> :																																						
5297								•															 					•								• 1	 			6-4
6991	•		•		•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	•	 	•	•	•	•	•	 •	•	•	•	•	•	• •		 •		6	-11
Catalo	g	Cu	t S	Sh	ee	ts											•						 										_						6	-18

-	BUILDING	BASELINE ENERGY (MBTU)	ECO ENERGY (MBTU)	ENERGY SAVINGS (MBTU)	1ST YEAR SAVINGS	COST	NON-ENERGY ANNUAL RECURRING	TOTAL NON-ENERGY NON- RECURRING	SPB (YR)	SIR
1	5297 6591	2,618	2,217	401	\$1,855 \$1,855	\$8,973 \$8,973	<b>8</b> 8	0\$	4.74	4.42
+	CEMP DRO IECT 5	5 269	4.466	803	\$3,710	\$17,946	\$0	\$0	4.74	4.42

	SIR	4.42	4.42	
	SPB (YR)	4.74	4.74	
**************************************	TOTAL NON-ENERGY NON- RECURRING	0\$	\$0	
TABLE 6.1 PROJECT SUMMARY: INDOW INSULATION - FEMP PROJECT 5	NON-ENERGY ANNUAL RECURRING	0\$	\$0	
AARY: EMP PRO	INVESTMENT	\$8,973 \$8,973	\$17,946	
TABLE 6.1 ECT SUMIN ATION - F	1ST YEAR SAVINGS	\$1,855 \$1,855	\$3,710	
TABLE 6.1 PROJECT SUMMARY: INSULATION - FEMP P	ENERGY SAVINGS (MJ)	423,509 423,509	847,017	
P IDOW II	ECO ENERGY (MJ)	2,338,893	4,711,292	
WIN	BASELINE ENERGY (MJ)	2,762,401 2,795,908	5,558,310	
	BUILDING	5297 6591	FEMP PROJECT 5	The state of the s
	ECO	/22	2	i.et. 5.1.5 The comparation of the contraction of t

LIFE CYCLE COST ANALYSIS SUMMARY

ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP)

INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3

PROJECT NO. & TITLE: ECO2 FEMP PROJECT 5 - WINDOW/WALL INSULATION
FISCAL YEAR 95

DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-19-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT A. CONSTRUCTION COST \$ 15988.
B. SIOH \$ 799.
C. DESIGN COST \$ 799.
D. TOTAL COST (1A+1B+1C) \$ 17587. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) 17587. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FUEL A. ELECT \$ .00 0. \$ 0. 15.61 \$ B. DIST \$ 6.60 0. \$ 0. 17.56 \$ C. RESID \$ .00 0. \$ 0. 19.97 \$ D. NAT G \$ 4.62 803. \$ 3709. 20.96 \$ E. COAL \$ .00 0. \$ 0. 17.58 \$ F. LPG \$ .00 0. \$ 0. 17.58 \$ F. LPG \$ .00 \$ 0. \$ 0. 16.12 \$ M. DEMAND SAVINGS \$ 0. 14.74 \$ N. TOTAL 803. \$ 3709. 0. \$ 0. \$ 0. \$ 77745. \$ 0. \$ 0. \$ 77745. 3. NON ENERGY SAVINGS (+) / COST(-) A. ANNUAL RECURRING (+/-) 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) (1) DISCOUNT FACTOR (TABLE A) 0. B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT DISCOUNTED
COST(-) OC FACTR SAVINGS(+)/
(1) (2) (3) COST(-)(4) d. TOTAL \$ 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 3709. 5. SIMPLE PAYBACK PERIOD (1G/4) 4.74 YEARS \$ 77745. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = 4.42 (IF < 1 PROJECT DOES NOT QUALIFY) . 11.05 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

STUDY: 5297ECO2 LCCID 1.080 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3 PROJECT NO. & TITLE: 5297ECO2 ECO-2 GLASS IMPROVEMENT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-18-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT A. CONSTRUCTION COST \$ 7994.

B. SIOH \$ 400.

C. DESIGN COST \$ 400.

D. TOTAL COST (1A+1B+1C) \$ 8793. F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1F - 1F) E. SALVAGE VALUE OF EXISTING EQUIPMENT \$ 0. 8793. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED FUEL \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) 0. \$ 0. 0. \$ 0. 0. \$ 0. 401. \$ 1855. 0. \$ 0. 0. \$ 0. 401. \$ 1855. A. ELECT \$ .00 15.61 B. DIST \$ 6.60 C. RESID \$ .00 D. NAT G \$ 4.62 E. COAL \$ .00 F. LPG \$ .00 17.56 19.97 20.96 17.58 16.12 14.74 0. 0. 38873. 0. 0. M. DEMAND SAVINGS 0. N. TOTAL 38873. 3. NON ENERGY SAVINGS (+) / COST (-) A. ANNUAL RECURRING (+/-) 0. (1) DISCOUNT FACTOR (TABLE A) 14.74 (2) DISCOUNTED SAVING/COST (3A X 3A1) 0. B. NON RECURRING SAVINGS(+) / COSTS(-) SAVINGS(+) YR DISCNT DISCOUNTED
COST(-) OC FACTR SAVINGS(+)/
(1) (2) (3) COST(-)(4) COST(-) OC FACTR
(1) (2) (3) ITEM d. TOTAL \$ 0. 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 1855. 5. SIMPLE PAYBACK PERIOD (1G/4) 4.74 YEARS 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 38873. 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) =4.42 (IF < 1 PROJECT DOES NOT QUALIFY) 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR): 11.05 %

LIFE CYCLE COST ANALYSIS SUMMARY

Totals

U08 DOORS/WNDW

71.82

111

\$2,258

\$4,671 \$1,991

\_\_\_\_\_\_ Estimate: BLDG 5297 Date: 06-Aug-94 Description: COST ESTIMATE Project: LIMITED EEAP(GLASSBid Date: Location: FORT KNOX, KY Job #: Location: FORT KNOX, KY Job #: Sq. footage: \*\*\*\*\*\*\* City indx 94013.02 City indx:Louisville, KY Description \_\_\_\_\_\_ Manhours Matl Labor Equipment Sub Total \_\_\_\_\_\_ ASTRAGALS, ALUM., FLAT, 1/8" X 2", "L" 0873022200 EXTRUSION, MAGNETIC 363.00 L.F. 1.92 Unit values 6.65 0.00 8.57 0.11 0.00 \$2,413 \$0 Totals 38.84 \$697 \$0 \$3,110 0884040010 GLS & GLZG: PLXGLS, CLR, 1/8"T, CUT SHEETS 764.00 S.F. 2.96 1.69 0.09 0.00 0.00 4.65 Unit values

\$1,294

\$0

\$0

\$0

\$0

\$3,552

\$6,662

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Line #	Description	on				
	Manhours	Matl	Labor	Equipment	Sub	Total
===========	=======	======				
ESTIMATE TOTAL	111	\$4,671	\$1,991	\$0	\$0	\$6,662
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$4,671	\$1,991	\$0	\$0	\$6,662 \$666 \$0 \$666
JOB TOTAL						\$7,994

Estimate: BLDG 5297

Date:

06-Aug-94

\$0

Description:

COST ESTIMATE

Project:

LIMITED EEAP(GLASSBid Date:

Location:

FORT KNOX, KY

Job #: 94013.02

Sq. footage:

\*\*\*\*\*

0.00%

10.00%

0.00%

10.00%

City indx:Louisville, KY

SUMMARY Equipment Sub Total Matl Labor Manhours \$4,671 \$1,991 \$0 \$0 \$6,662 U08 DOORS/WNDW 111 \$0 \$6,662 TOTAL \$4,671 \$1,991 \$0 . 111 \$0 SALES TAX 0.00% Ġ0 MATL MARKUP 0.00% \$0 LABOR MARKUP 0.00% \$0 EQUIPT MARKUP 0.00%

\$1,991

\$4,671

JOB TOTAL

BOND

PROFIT

SUB MARKUP

CONTINGENCY

TOTAL BEFORE CONTINGENC

PAGE 6-7

\$0

\$0

\$6,662

\$7,994

\$666

\$666

\$0

### ECO - 2: WINDOW/ WALL INSULATION

## BUILDING HEATING TEMPERATURE SETPOINT: 70 F  OUTSIDE DESIGN TEMPERATURE  1 AIR CHGS X 447990 VOL (CU FT) X 69 F TEMP DIFF X 0.019 = 0.59  14933 AREA (SF) X 0.105 HRSFF) X 69 F TEMP DIFF X 0.019 = 0.03  14933 AREA (SF) X 0.176 HRSFF) X 69 F TEMPERATURE = 0.11  10810 AREA (SF) X 0.176 HRSFF) X 69 F TEMPERATURE = 0.13  3654 AREA (SF) X 0.176 HRSFF) X 69 F TEMPERATURE = 0.01  294 AREA (SF) X 0.65 HRSFF) X 69 F TEMPERATURE = 0.00  535 AREA (SF) X 0.65 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.65 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.65 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.58 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HRSFF) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HRSFF) X 69 F TEMPERATURE = 0.00	## SET TOTAL BUILDING HEATING TEMPERATURE SETPOINT: 70 F    1	BUILDING NUMBER:	1000				A GLERAL CONTRACTOR	1				
1 AIR CHGS X 447990 VOL (CU FT) X 69 FTEMP DIFF X 0.019 = 0.59  14933 AREA (SF) X 0.105 HR.SF-F) X 69 FTEMP DIFF X 0.011 = 0.03  10810 AREA (SF) X 0.176 HR.SF-F) X 69 FTEMPERATURE = 0.11  10810 AREA (SF) X 0.176 HR.SF-F) X 69 FTEMPERATURE = 0.01  294 AREA (SF) X 0.055 HR.SF-F) X 69 FTEMPERATURE = 0.01  764 AREA (SF) X 1.235 HR.SF-F) X 69 FTEMPERATURE = 0.00  765 AREA (SF) X 1.235 HR.SF-F) X 69 FTEMPERATURE = 0.00  766 AREA (SF) X 0.566 HR.SF-F) X 69 FTEMPERATURE = 0.00  767 AREA (SF) X 0.566 HR.SF-F) X 69 FTEMPERATURE = 0.00  768 AREA (SF) X 0.566 HR.SF-F) X 69 FTEMPERATURE = 0.00  769 AREA (SF) X 0.566 HR.SF-F) X 69 FTEMPERATURE = 0.00  760 AREA (SF) X 0.566 HR.SF-F) X 69 FTEMPERATURE = 0.00  760 AREA (SF) X 0.566 UVALUE (BTU/C) 69 FTEMPERATURE = 0.00  7	1 AIR CHGS X 447990 VOL (CU FT) X 69 FTEMP DIFF X 0.019 = 0.59  14933 AREA (SF) X 0.105 U VALUE (BTU/L 69 FTEMPERATURE		1870	ı		BUILDING F OUTSIDE D TEMPERAT	HEATING TEMPERA ESIGN TEMPERATI URE DIFFERENCE	JRE JRE				
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10810 AREA (SF) X 0.176 U VALUE (BTU/ 3654 AREA (SF) X 0.17 U VALUE (BTU/ 294 AREA (SF) X 0.65 U VALUE (BTU/ 53 AREA (SF) X 1.235 U VALUE (BTU/ AREA (SF) X 0.56 HR SF - F) X 0 DIFFERENCE = 0.00	10810 AREA (SF) X 0.176	MTL DECK, FLAT ROOF =		AREA (SF)	×	0.105	U VALUE (BTU/ HR-SF-F) X	69		11	0.11	MBTU / HR
3654 AREA (SF) X 0.17 U VALUE (BTU) 69 F TEMPERATURE = 0.04  294 AREA (SF) X 0.65 U VALUE (BTU) 69 F TEMPERATURE = 0.01  764 AREA (SF) X 1.235 U VALUE (BTU) 69 F TEMPERATURE = 0.07  AREA (SF) X 1.235 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 DIFFERENCE = 0.00	3654 AREA (SF) X 0.17 U VALUE (BTU/ 69 F TEMPERATURE = 0.04  294 AREA (SF) X 0.65 U VALUE (BTU/ 69 F TEMPERATURE = 0.01  764 AREA (SF) X 1.235 U VALUE (BTU/ 69 F TEMPERATURE = 0.07  AREA (SF) X 1.235 U VALUE (BTU/ 69 F TEMPERATURE = 0.07  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00	FACE BK/ CMU BLK WALL =		AREA (SF)	×	0.176		69		II	0.13	MBTU / HR
294 AREA (SF) X 0.65 U VALUE (BTU) 69 F TEMPERATURE = 0.01  764 AREA (SF) X 1.235 U VALUE (BTU) 69 DIFFERENCE 53 AREA (SF) X 1.235 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 DIFFERENCE = 0.00	294 AREA (SF) X 0.65 U VALUE (BTU) 69 F TEMPERATURE = 0.01  764 AREA (SF) X 1.235 HR-SF-F) X 69 F TEMPERATURE = 0.07  53 AREA (SF) X 1.235 HR-SF-F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR-SF-F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR-SF-F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR-SF-F) X 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR-SF-F) X 69 F TEMPERATURE = 0.00  BYALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR-SF-F) X 69 F TEMPERATURE = 0.00  BYALUE (BTU) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR-SF-F) X 69 F TEMPERATURE = 0.00  BYALUE (BTU) 69 F TEMPERATURE = 0.0	CORR MTL PNL WALL =		AREA (SF)	×	0.17		69		11	0.04	MBTU / HR
764 AREA (SF) X 1.235 U VALUE (BTU/ 69 F TEMPERATURE = 0.07  53 AREA (SF) X 1.235 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 F TEMPERATURE = 0.00	764 AREA (SF) X 1.235 U VALUE (BTU/ 53 AREA (SF) X 1.235 U VALUE (BTU/ AREA (SF) X 0.560 U VAL	TINTED DBL PANE DOORS =		AREA (SF)	×	0.65		69	· ⊔	n	0.01	MBTU / HR
53 AREA (SF) X 1.235 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 HR - SF - F) X 69 DIFFERENCE = 0.00	53         AREA (SF)         X         1.235         U VALUE (BTU)         69         F TEMPERATURE LENCE         = 0.00           AREA (SF)         X         0.56         U VALUE (BTU)         69         F TEMPERATURE LENCE         = 0.00           AREA (SF)         X         0.583         U VALUE (BTU)         69         F TEMPERATURE LENCE LIFERENCE         = 0.00           AREA (SF)         X         0.56         U VALUE (BTU)         69         F TEMPERATURE LENCE LIFERENCE LIFERENCE         = 0.00           AREA (SF)         X         0.56         U VALUE (BTU)         69         F TEMPERATURE LENCE LIFERENCE LIFERENCE LIFERENCE         = 0.00           AREA (SF)         X         0.615         U VALUE (BTU)         69         F TEMPERATURE LIFERENCE LI	CLR SINGLE PANE WIN'WS (GYM) =	764	AREA (SF)	×	1.235		69		11	0.07	MBTU / HR
AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/ 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 DIFFERENCE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 DIFFERENCE = 0.00	AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.583 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.615 HR-SF-F) X 69 F TEMPERATURE = 0.00	LR SGL PANE WINDOWS IN LOCKER ROOMS=	53	AREA (SF)	×	1.235		69		11	00.00	MBTU / HR
AREA(SF) X 0.583 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.56 U VALUE (BTU/ 69 DIFFERENCE = 0.00  AREA(SF) X 0.615 U VALUE (BTU/ 69 DIFFERENCE = 0.00	AREA (SF) X 0.583 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.56 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.615 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.615 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.615 U VALUE (BTU/) 69 F TEMPERATURE  AREA (SF) X 0.615 HR - SF - F) X 69 F TEMPERATURE  TOTAL BASELINE HEAT LOSSES = 0.98	MTL OVERHEAD DOORS =		AREA (SF)	×	0.56		69		11	0.00	MBTU / HR
AREA(SF) X 0.56 U VALUE(BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.56 U VALUE(BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.615 U VALUE(BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.615 U VALUE(BTU/ 69 F TEMPERATURE = 0.00	AREA(SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  TOTAL BASELINE HEAT LOSSES = 0.98	OOD GLAZED O'HEAD DR =		AREA (SF)	×	0.583		69		11	0.00	MBTU / HR
AREA(SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA(SF) X 0.615 HR - SF - F) X 69 DIFFERENCE = 0.00	AREA (SF) X 0.56 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  AREA (SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  TOTAL BASELINE HEAT LOSSES = 0.98 = 1,032.31	LG MTL SLIDING DOOR =		AREA (SF)	×	0.56		69	_	п	0.00	MBTU / HR
AREA(SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00	AREA(SF) X 0.615 U VALUE (BTU/ 69 F TEMPERATURE = 0.00  TOTAL BASELINE HEAT LOSSES = 1,032.31	METAL PERSONNEL DR=		AREA (SF)	×	0.56		69		П	0.00	MBTU / HR
	= 0.98 = 1,032.31	OOD/GLAZED PERSONNEL=		AREA (SF)	×	0.615	U VALUE (BTU/ HR - SF - F) X	69		п	0.00	MBTU / HR
										H	1,032.31	MJ/HR

### **ECO - 2: WINDOW/ WALL INSULATION**

**ECO - 2: WINDOW/ WALL INSULATION** 

5297

PAGE 3 OF 3

 SYSTEM EFFICIENCY
 60%
 60%
 60%
 BUILDING NUMBER

 OUTSIDE DESIGN TEMP (F)
 1
 1
 1 MBTU = 1055 MJ

 HTG TEMP SETPOINT (F)
 70
 70
 0.019=CONSTANT

 HEATING DEGREE DAYS
 4616
 .81 = CONSTANT FOR

 TOTAL HEAT LOSSES
 0.98
 0.83
 65 F DEGREE-DAYS F

 (MBTU / HR)
 \$6.60
 \$6.60

\$6.60 \$4.62 \$10.84

\$6.60 \$4.62 \$10.84

\$ /MBTU -NATURAL GAS

\$ /MBTU -PPG

GLOSSARY OF TERMS

1 MBTU = 1055 MJ

0.019=CONSTANT

81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE

CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS

65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2

	ANNUAL HEA	TING ENER	Gγ (	ANNUAL HEATING ENERGY CONSUMPTION (DEGREE DAY METHOD)	<b>&gt;</b>	1ETHOD	
BASELINE =	0.98	MBTU / HR X	4616	24 HRS/DAY			•
	9.0	SYS EFF X 69	69	TEMP DIFFERENCE		2,618.39	_
	2,618.39	MBTU/YR	×	CORR FACTOR 1 =			

BASELINE =	2,618.39	MBTU/YR X 6.6	6.6	\$ /MBTU	11	17,281.39 \$ /YR	\$ MR
ECO - 2 =	2,216.96	MBTU/YR X 6.6	6.6	\$ /MBTU	11	= 14,631.94 \$ /YR	\$ YR
	FCO - 2 ANNU	IAL HEATING F	ENERGY	FCO2 ANNIJAL HEATING ENERGY COST SAVINGS = 2.649.45 \$ /YR	II	2.649.45	S VR

MBTUMR

MJ/YR

423,510.48

11 #

ECO - 2 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS

401.43

MBTUYR

2,216.96

II

CORR FACTOR

×

**MBTU/YR** 

2,216.96

MBTU/YR

2,216.96

11

24 HRS/DAY

DEGREE DAYS X
TEMP DIFFERENCE

4616

MBTU/HR X

0.83

ECO - 2 =

SYS EFF

MBTU/YR

2,618.39

**MBTU/YR** 

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: 6591ECO2
ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080 LIFE CYCLE COST ANALYSIS SUMMARY INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3 PROJECT NO. & TITLE: 6591ECO2 ECO-2 GLASS IMPROVEMENT FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-18-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT 7994. A. CONSTRUCTION COST \$ B. SIOH \$ 400. C. DESIGN COST \$ 400. D. TOTAL COST (1A+1B+1C) \$ 8793. F. PUBLIC UTILITY COMPANY REBATE \$
G. TOTAL INVESTMENT (1D - 1E - 1F) 0. 0. 8793. 2. ENERGY SAVINGS (+) / COST (-) DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) FUEL 

 0.
 \$
 0.
 15.61

 0.
 \$
 0.
 17.56

 0.
 \$
 0.
 19.97

 401.
 \$
 1855.
 20.96

 0.
 \$
 0.
 17.58

 0.
 \$
 0.
 16.12

 \$
 0.
 14.74

 401.
 \$
 1855.

 A. ELECT \$ .00 B. DIST \$ 6.60 0. 15.61 \$ 0. \$ 0. \$ 38873. \$ 0. \$ 0. \$ 38873. C. RESID \$ .00 D. NAT G \$ 4.62 E. COAL \$ .00 F. LPG \$ .00 M. DEMAND SAVINGS N. TOTAL 3. NON ENERGY SAVINGS (+) / COST(-) A. ANNUAL RECURRING (+/-) 14.74 (1) DISCOUNT FACTOR (TABLE A) 0. (2) DISCOUNTED SAVING/COST (3A X 3A1) B. NON RECURRING SAVINGS (+) / COSTS (-) SAVINGS(+) YR DISCNT DISCOUNTED

COST(-) OC FACTR SAVINGS(+)/

(1) (2) (3) COST(-)(4) COST(-) OC FACTR (1) (2) (3) TTEM d. TOTAL \$ 0. 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 1855. 5. SIMPLE PAYBACK PERIOD (1G/4) 4.74 YEARS 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) \$ 38873. 7. SAVINGS TO INVESTMENT RATIO (SIR) = (6 / 1G) = (IF < 1 PROJECT DOES NOT QUALIFY) 4.42

8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

11.05 %

Totals

U08 DOORS/WNDW

Estimate: BLDG 6591 Date: 06-Aug-94
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date: Project: Location: FORT KNOX, KY Job #: Sq. footage: \*\*\*\*\*\* City ind City indx:Louisville, KY . Description \_\_\_\_\_\_ Manhours Matl Labor Equipment Sub Total \_\_\_\_ ASTRAGALS, ALUM., FLAT, 1/8" X 2", "L" 0873022200 363.00 L.F. EXTRUSION, MAGNETIC 0.00 8.57 1.92 0.00 6.65 Unit values 0.11 \$0 \$0 \$3,110 \$2,413 \$697 38.84 Totals GLS & GLZG: PLXGLS, CLR, 1/8 "T, CUT SHEETS 0884040010 764.00 S.F. 0.00 4.65 2.96 1.69 0.00 0.09 Unit values

\$1,294

\$4,671 \$1,991

\$0

\$0

\$0

\$0

\$3,552

\$6,662

\$2,258

71.82

111

			======			
Line #	Description					
	Manhours	Matl =======	Labor	Equipment	Sub =======	Total
ESTIMATE TOTAL	111	\$4,671	\$1,991	\$0	\$0	\$6,662
SALES TAX MATL MARKUP LABOR MARKUP EQUIPT MARKUP SUB MARKUP	0.00% 0.00% 0.00% 0.00% 0.00%	\$0 \$0	<b>\$0</b>	\$0	\$. \$0	
TOTAL BEFORE CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$4,671	\$1,991	<b>\$</b> 0	\$0	\$6,662 \$666 \$0 \$666
JOB TOTAL						\$7,994

Estimate: BLDG 6591 Date: 06-Aug-94
Description: COST ESTIMATE
Project: LIMITED EEAP(GLASSBid Date:
Location: FORT KNOX, KY Job #: 94013.02

Sq. footage:	*****		City indx	:Louisville,	KY	
==========	SU	JMMARY				
	Manhours	Matl	Labor	Equipment	Sub	Total
	========	======				
U08 DOORS/WNDW	111	\$4,671	\$1,991	\$0	\$0	\$6,662
TOTAL	111	\$4,671	\$1,991	\$0	\$0	\$6,662
SALES TAX MATL MARKUP	0.00%	\$0 \$0				
LABOR MARKUP EQUIPT MARKUP	0.00%	7 -	\$0	\$0		
SUB MARKUP	0.00%				\$0	
TOTAL BEFORE C	ONTINGENC	\$4,671	\$1,991	\$0	\$0	\$6,662 \$666
BOND PROFIT	0.00%					\$0 \$666
JOB .TOTAL						\$7,994

### ECO - 2: WINDOW/ WALL INSULATION

								PAGE 1	1013
BUILDING NUMBER:	6591	ı	BUILDING H OUTSIDE D TEMPERAT	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATURE URE	SETPOINT: 70 F	<u>пт'п</u>		
INFILTRATION LOSSES =	-	_ AIR CHGS X	447990	VOL (CUFT) X	69	F TEMP DIFF X 0.019	ii	0.59	MBTU / HR
FLOOR LOSSES =	466	LINEAR	LINEAR FEET OF PERIMETER	RIMETER X	69	F TEMP DIFF X 0.81	11	0.03	MBTU / HR
SURFACE HEAT LOSSES MTL DECK, FLAT ROOF =	14933	AREA (SF) X	0.105	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	11	0.11	MBTU / HR
4" FACE BK/ CMU BLK WALL =	10810	AREA (SF) X	0.176	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	11	0.13	MBTU / HR
CORR MTL PNL WALL =	3654	AREA(SF) X	( 0.17	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	II	0.04	MBTU / HR
CLR SINGLE PANE GLASS DOORS W/ SIDELITES =	294	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	11	0.03	MBTU / HR
CLR SGL PANE WIN'W (GYM) =	764	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	Ħ	0.07	MBTU / HR
CLR SGL PANE WINDOWS IN LOCKER ROOMS=	53	AREA (SF) X	1.235	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	n	0.00	MBTU / HR
MTL OVERHEAD DOORS =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
WOOD GLAZED O'HEAD DR =		AREA (SF) X	( 0.583	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
LG MTL SLIDING DOOR =		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	и	0.00	MBTU / HR
METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
WOOD/GLAZED PERSONNEL=		_ AREA (SF) X	( 0.615	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR

MBTU / HR MJ/HR

0.99 1,044.83

11 11

**TOTAL BASELINE HEAT LOSSES** 

### ECO - 2: WINDOW/ WALL INSULATION

MBTU/HR	0.84	11 1	TOTAL ECO HEAT LOSSES	HE/	TOTAL EC					
MBTU / HR	0.00	11	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.615	×	AREA (SF) X	0	WOOD/GLAZED PERSONNEL=
MBTU / HR	0.00	II	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.56	×	AREA (SF)	0	METAL PERSONNEL DR=
MBTU / HR	0.00	Ħ	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.56	×	AREA (SF)	0	LG MTL SLIDING DOOR =
MBTU / HR	0.00	H	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.583	×	AREA (SF)	0	WOOD GLAZED O'HEAD DR =
MBTU / HR	0.00	n	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.56	×	AREA (SF)	0	MTL OVERHEAD DOORS =
MBTU / HR	0.00	0	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	1.235	×	AŘEA (SF)	53	CLR SGL PANE WINDOWS IN LOCKER ROOMS=
MBTU / HR	0.03	II	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.6175	×	AREA (SF) X	764	CLR SGL PANE WIN'W W/ SEALMASTER INSUL WIN'W(GYM) =
MBTU/HR	0.03	п	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	1.235	×	AREA (SF)	294	CLR SINGLE PANE GLASS DOORS W/ SIDELITES =
MBTU / HR	0.04	П	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.17	×	AREA (SF)	3654	CORR MTL PNL WALL =
MBTU / HR	0.13	11	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.176	×	AREA (SF)	10810	4" FACE BK/ CMU BLK WALL =
MBTU / HR	0.11	II	F TEMPERATURE DIFFERENCE	69	U VALUE (BTU/ HR - SF - F) X	0.105	×	AREA (SF)	14933	SURFACE HEAT LOSSES MTL DECK, FLAT ROOF =
MBTU / HR	0.03	11	F TEMP DIFF X 0.81	69	LINEAR FEET OF PERIMETER X	ET OF P	Y FE	LINEAF	466	FLOOR LOSSES =
MBTU / HR	0.47	H ,	TEMP DIFF X 0.019	69 F	VOL (CUFT) X 69 F TEMP DIFF	447990	×	AIR CHGS X	0.8	INFILTRATION LOSSES =
		, ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	RE SETPOINT: 70 F	ATURE	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	BUILDING OUTSIDE TEMPERA			6591	BUILDING NUMBER:
PAGE 2 OF 3	PAGE									

MBTU / HR MJ/HR

0.84 886.57

11 11

# FT KNOX LIMITED EEAP (GLASS)

# ECO - 2: WINDOW/ WALL INSULATION

PAGE 3 OF 3

								•	
ECO - 2	%09	~	70	4616	70 0	0.0	\$6.60	\$4.62	\$10 BA
BASELINE	%09	_	70	4616	00	99.0	\$6.60	\$4.62	\$10 BA
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	(MBTU / HR)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	COO LITAWA

BUILDING NUMBER	6591	
	GLOSSARY OF TERMS	
1 MBTU = 1055 MJ		
0.019=CONSTANT		
.81 = CONSTANT FOR SLA	.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	
CORR FACTOR = EMPIR	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	
65 F DEGREE-DAYS FROM	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2	
		,

A	ANNUAL HEATIN	TING ENER	GY C	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	EE DA	Y METHC	(Q(	
BASELINE =	0.99	MBTU/HR X SYS EFF X	4616	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 69 TEMP DIFFERENCE	" ≽	2,650.15	MBTU/YR	
	2,650.15	MBTU/YR	×	CORR FACTOR 1	II		2,650.15	MBTUMR
ECO - 2 =	0.84	MBTU/HR X SYS EFF X	4616	MBTU/HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 69 TEMP DIFFERENCE	 	2.248.72	MBTU/R	
	2,248.72	MBTU/YR	×	CORR FACTOR 1	II		2,248.72	MBTU/YR
	ECO - 2	ANNUAL HEATI	ING EI	ECO - 2 ANNUAL HEATING ENERGY CONSUMPTION SAVINGS	" SSN		401.43	MBTU/YR

	ANNOAL	ANNUAL HEATING ENERGY COST	NERG	Y COST				
BASELINE =	2,650.15	MBTU/YR X 6.6	6.6	\$ /MBTU	II	17,490.98 \$ /YR	\$ YR	
ECO - 2 =	2,248.72	MBTU/YR X 6.6	6.6	\$ /MBTU	11	14,841.53 \$ MR	_\$ /YR	
	ECO - 2 ANNL	JAL HEATING E	NERGY	ECO - 2 ANNUAL HEATING ENERGY COST SAVINGS = 2,649.45 \$ //R	11	2,649.45	\$ /YR	



dryvil Q DS118

An Exterior Wall Insulation and Finish System

# Outsulation System Specifications



#### INTRODUCTION

This document contains the Manufacturer's Specification for the Outsulation System. These specifications follow the popular Construction Specification Institute 3-part format.

#### PROPRIETARY VERSUS NONPROPRIETARY

These specifications, as written, are proprietary, referring to Dryvit Systems, Inc. and Its products, by name. They can easily be converted to the nonproprietary specifications by eliminating the proprietary names and substituting the nonproprietary words or phrases:

**Proprietary** 

Dryvit Systems, Inc.

The Dryvit Outsulation® System

Primus/Adhesive®, Primus/Adhesive

Mixture, ADEPS®

Insulation Board

**Dryvit Reinforcing Mesh** 

Dryvit Detail<sup>®</sup> Short Rolls

Reinforcing Mesh

Dryvit Standard" Reinforcing Mesh

Dryvit Standard Plus™ Reinforcing Mesh

Dryvit Intermediate® Reinforcing Mesh

Panzer<sup>®</sup> 20 Mesh

**Dryvit Finish** 

Quarzputz®, Sandblast®, Freestyle®, Carrara™,

Bed-Rok®, Sandpebble®,

Stone Mist®, Quarzite™

Prep™

Demandit®

Revvvit®

Prvmit<sup>∞</sup>

riyiiii."

Color Prime™

Nonproprietary

the Manufacturer

the System

Adhesive, Adhesive Mixture,

Ready-Mixed Adhesive

Insulation Board

Reinforcing Mesh

Detail Short Rolls Reinforcing

Mesh

Standard Reinforcing Mesh

Standard Plus Reinforcing Mesh

Intermediate Reinforcing Mesh

Heavy Reinforcing Mesh

Finish

Describe texture or give designation

Precoat

Coatina

Coating

Primer

Primer

#### TAILORING THE DRYVIT MANUFACTURER'S SPECIFICATIONS TO YOUR PROJECT

These specifications cover all the common ways of using the Outsulation System. Most projects use only a few of the possible combinations of these materials and methods. To tailor the Specifications to your project, simply use those sections which apply. Also, it may be prudent to place certain parts of the Dryvit Specification in other parts of the project's total specification, such as sealants and metal framing. For assistance in preparing your specification, contact your Dryvit Distributor or Dryvit Systems, Inc.

#### METRIC EQUIVALENTS

Metric equivalents are included after the U.S. customary units (English System) in parentheses, thus: 1/2" (13mm) 1.0 pcf (16Kg/m3)

Please note that the U.S. customary units govern, i.e., the metric equivalents may not be exact but rather represent commonly used equivalents.

#### WARNING

The Outsulation System is designed as a barrier wall system, which means that it is detailed to prevent water from entering the system. If specifications are not followed and proper detail not adhered to, water may intrude the system, resulting in possible damage to the system and other building elements in the wall.

#### **DISCLAIMER**

Information contained in this specification conforms to standard detail and product recommendations for the installation of Dryvit Systems, Inc. products as of the date of publication of this document and is presented in good faith. Dryvit Systems, Inc. assumes no liability, expressed or implied, as to the architecture, engineering or workmanship of any project. To insure that you are using the latest, most complete information, contact Dryvit . Systems, Inc.

For Further Information, Contact Us At One Energy Way P.O. Box 1014 West Warwick, RI 02893 (401) 822-4100 FAX: (401) 823-8820

Date of Issuance: July 9, 1991



### DRYVIT SYSTEMS, INC. MANUFACTURER'S SPECIFICATIONS

#### SECTION 07240 OUTSULATION EXTERIOR INSULATION AND FINISH SYSTEM

#### PART I - GENERAL

1.01 SECTION INCLUDES

- A. Exterior Insulation and Finish System Type PB as defined by the Exterior Insulation Manufacturers Association (EIMA),
- B. Molded Expanded Polystyrene (MEPS) Insulation Board.

1.02 RELATED SECTIONS

- A. Unit Masonry 04200.
- B. Concrete 03300.
- C. Sheathing 06100.
- D. Light Gauge Cold-Formed Steel Framing 05400.
- E. Sealants 07900.

1.03 REFERENCES

ASTM B 117 (Federal Test Standard 141A Method 6061) Method of Salt Spray (Fog) Testing

ASTM C 79 Test Method for Gypsum Sheathing Board

ASTM C 150 Specification for Portland Cement

ASTM D 897 Test Method for Tensile Properties of Adhesive Bonds

ASTM D 968 (Federal Test Standard 141A Method 6191) Test Method for Abrasion Resistance of Organic Coatings by the Falling Abrasive Tester

ASTM D 2247 (Federal Test Standard 141A Method 6201) Method of Testing Coated Metal Specimens at 100 Percent Relative Humidity

ASTM E 84 Test Method for Surface Burning Characteristics of Building Materials

ASTM E 96 Tests for Water Vapor Transmission of Materials

ASTM E 108 (Modified) Method of Fire Tests of Roof Coverings

ASTM E 119 Method for Fire Tests of Building Construction and Materials

ASTM E 330 Test Method for Structural Performance of Exterior Windows, Curtain Walls, and Doors by Uniform Static Air Pressure Difference

ASTM E 547 Test Method for Water Penetration of Exterior Windows, Curtain Walls, and Doors by Cyclic Static Air Pressure Differential

ASTM G 23 (Federal Test Standard 141A Method 6151) Recommended Practice for Operating Light and Water Exposure Apparatus (Carbon-Arc Type) for Exposure of Non-metallic Materials

AP81-2 Dryvit's Application Bulletin #81-2

DS131 Standard Specifications for Molded Expanded Polystyrene Insulation Boards for Use in Dryvit Systems, Inc.

DS140 Carrara Application Instructions

DS141 Bed-Rok Application Instructions

DS143 ADEPS Application Instructions

DS153 Expansion Joints and Sealants

DS156 Substrates

DS201 The Outsulation System

DS204 Outsulation System Pocket Guide

DS402 NCB (Base Coat)

DS407 ADEPS (Adhesive for EPS)

DS414 Primus/Adhesive

DS416 Finishes

DS428 Sandpebble

DS429 Quarzite

EIMA Std 101.86 Method for Resistance of Exterior Insulation Finish Systems to the Effects of Rapid Deformation (Impact)

MIL Std E5272 Environmental Testing

MIL Std 810B Environmental Test Methods

ULC \$101 Standard Methods of Fire Endurance Tests of Building Construction Materials 1.04 DEFINITIONS

- A. ADEPS: A ready-to-use, factory-mixed, fully formulated water-based acrylic copolymer adhesive.
- B. Applicator: The contractor that applies the Outsulation System.
- C. Backwrapping: Covering the exposed edge and minimum 2 1/2" on each face of the MEPS board with the reinforced base coat.





- D. Base Coat: The layer consisting of one or more layers of Reinforcing Mesh fully embedded in the Base Coat Mixture applied to the outside surface of the MEPS.
- E. Building Expansion Joint: A joint through the entire building structure designed to accommodate structural movement.
- F. Color Prime: Pigmented acrylic primer for Dryvit finishes.
- G. Designer: The person responsible for the creation and/or execution of plans and specifications for a project or structure.
- H. Insulation Board: Molded expanded polystyrene board (MEPS) meeting the specifications of Dryvit Systems, Inc. and produced by a manufacturer acceptable to Dryvit Systems, Inc.
- 1. Reinforcing Mesh: Glass fiber mesh(es) supplied by and meeting the specifications of Dryvit Systems, Inc. used to reinforce the base coat and to provide impact resistance.
- J. Dryvit: Dryvit Systems, Inc., a Rhode Island corporation.
- K. Expansion Joint: A designed interruption in the continuity of a material, assembly, or system, which facilitates movement.
- L. Finish: A factory-mixed, acrylic coating with integral color, available in a variety of texture types, applied to the outside surface of the base coat.
- M. Lamina: The Dryvit Base Coat layer combined with the Dryvit Finish layer.
- N. Panel Fabricator: The contractor who fabricates the panelized Outsulation System.
- O. Panel Erector: The contractor who installs the panelized Outsulation System.
- P. Prep: A specially formulated acrylic latex precoat designed to be used with Carrara Finish.
- Q. Primus/Adhesive: A factory-mixed acrylic-based product.
- R. Base Coat Mixture: A field-mixed blend of Base Coat material and Portland cement.
- S. Prymit: A water-based primer which ensures adhesion to previously painted substrates.
- T. Sheathing: A substrate in sheet form.
- U. Substrate: The material to which the Outsulation System is affixed.
- V. Substrate System: The total wall assembly including the attached substrate to which the Outsulation System is affixed.

#### 1.05 SYSTEM DESCRIPTION

- A. The Dryvit Outsulation System is an externally reinforced exterior insulation and finish system consisting of an adhesive, insulation board, fiberglass reinforcing mesh fully embedded in a base coat mixture, and an aesthetic finish.
  - The sealant system and the substrate are not considered part of the Dryvit system. In addition, expansion joint design and location is the responsibility of the Designer.
- B. Methods of Installation:
  - 1. Field Applied: The Outsulation System applied to the substrate system in place.
  - 2. Panelized: The Outsulation System is shop-applied to prefabricated wall panels.
- C. Design Requirements:
  - Dryvit Systems, Inc.'s current published information shall be followed for suggested detail treatments.
    - a. At all termination locations, the MEPS shall be completely encapsulated by the base coat.
    - b. The length and slope of inclined surfaces shall follow the guidelines listed below: 1) Minimum slope: 6" (152mm) of rise in 12" (305mm) of horizontal projection. 2) Maximum length of slope: 10" (254mm). 3) Inclined surfaces shall not be used for areas defined as roofs by building codes.
  - 2. Corners shall be reinforced by wrapping with Reinforcing Mesh or installing Corner Mesh.
  - 3. Openings shall be reinforced using a 9 1/2" (241 mm) wide strip of Detail Reinforcing Mesh laid at a 45° angle.
  - 4. Dimensional Tolerances:
    - a. All substrates shall be flat within 1/4" (6.4mm) within a 4' (1.2m) radius.
  - 5. Substrate/Substrate Systems:
    - a. Shall be engineered by others which includes but is not limited to connections.
    - b. The maximum deflection under full flexural design loads of the substrate system shall not exceed L/240.
    - c. It is the Applicator's responsibility to ensure the substrate is acceptable for application of the Outsulation System.
    - d. Application of the Outsulation System shall be to the following recommended substrates only:
      - 1) Unit masonry, unglazed brick, concrete, concrete block or stucco, all of which must be sound and unpainted.
        - a) Painted substrates shall have the paint removed using materials and methods which result in no more than 10% of the remaining surface having paint or may alternatively be prepared by coating with Prymit and tested for adhesion.





- 2) Exterior grade gypsum sheathing with regular or Type X core meeting ASTM C 79 requirements at the time of application of the actual system.
- 3) Exterior cement board.
- 4) Silicone-treated gypsum core sheathing surfaced with Inorganic fiberglass mats coated with Dryvit Color Prime or factory-applied alkali-resistant coating.
- 5) Fiber-reinforced calcium silicate panel coated with Dryvit Color Prime.
- 6) Unpainted wood fiber board; sound, unpainted minimum APA Exposure 1 grade plywood; and other non-veneer boards: using ADEPS adhesive only.
  - a) Plywood and Oriented Strand Board (OSB) shall be minimum 1/2" (12mm) thick and follow APA recommendations for installation.
  - b) Plywood and OSB shall be minimum 4 ply, APA Exposure 1 or Exterior Grade C-D or better, installed best side facing out.
- 7) Galvanized steel lath (2.5 or 3.4 lbs./sq.yd.) for use over masonry substrates, ayosum sheathing or adhesively bonded wood fiber board.
- 6. Sealants/Sealant Systems:
  - a. Sealant System: The sealant, closed-cell backer rod, bond breaker tape, primer and accessories manufactured and installed by others.
  - b. Sealants:
    - 1) Shall be compatible with the Outsulation System. Refer to Dryvit publication DS153 for
    - 2) Outsulation System materials shall be fully dry prior to sealant system installation (typically 24-48 hours).
- 7. Expansion Joints:
  - a. Expansion and contraction of the Outsulation System and adjacent materials shall be taken into account in the design of expansion joints. Expansion joint design and location is the responsibility of the Designer.
  - b. Continuous expansion joints in the Outsulation System shall be installed but not limited to the following locations:
    - 1) Where expansion joints occur in the substrate system.
    - 2) Where building expansion joints occur.
    - 3) Where Outsulation panels abut one another for a panelized installation.
    - 4) At floor lines in wood frame construction.
    - 5) Where the Outsulation System abuts dissimilar materials.
    - 6) Where the substrate changes.
    - 7) Where significant structural movement occurs such as long continuous elevations, changes in roof line, and changes in building shape and structural system.
  - c. In addition to expansion joint requirements, control joints are required with Bed-Rok finish so that no area exceeds 400 square feet (37.2 sq.m) (20 feet [6.1m] maximum in any direction and the length-to-width ratio does not exceed 2.5).
- D. Performance Requirements: The Outsulation System is designed to meet or exceed the following: Physical Tests:

  - a. Abrasion Resistance: Federal Test Standard 141A Method 6191 (ASTM D 968); no deleterious effects after 114 gallons (500 liters).
  - b. Absorption Freeze: 60 cycles soak at 68°F (20°C) for four days, then 14°F (-10°C) for two hours, then 68°F (20°C) for two hours; no checking, cracking, or splitting.
  - c. Accelerated Weathering: Federal Test Standard 141A Method 6151 (ASTM G 23); 2,000 hours. No deterioration.
  - d. Impact Resistance: In accordance with EIMA STD 101.86

Standard Mesh — 25-49 in.-lbs.

Standard Plus Mesh — 50-89 in.-lbs.

Intermediate Mesh — 90-150 in.-lbs.

Panzer 20 Mesh — over 150 in.-lbs.

- e. Mildew Resistance: MIL Std 810B; passes.
- f. Moisture Resistance: Federal Test Standard 141A Method 6201 (ASTM D 2247); no deleterious effects after 14 days.
- g. Salt Spray Resistance: Federal Test Standard 141A Method 6061 (ASTM B 117); 5% concentration for 300 hours. No deleterious effects.
- h. Water Penetration: ASTM E 331; no water penetration to the innermost surface of the test
- i. Water Vapor Transmission (ASTM E 96 Water Method Procedure B): Standard Iamina 14 grains/hour/ft.



#### 2. Structural Tests:

a. Full Scale Structural Tests: ASTM E 330; minimum failure load under suction force of 90 psf unless otherwise specified.

#### 3. Fire Tests:

- a. ASTM E 84 on Coatings and Insulation Board. Results: flame spread rating less than or equal to 20, smoke developed rating less than or equal to 10 for coatings; flame spread rating of not more than 25, smoke developed rating of not more than 450 for Insulation Board.
- b. Modified ASTM E 108 Method (Diversified Fire Test). Results:
  - 1) Significant flame propagation outside immediate area of flame impingement should not occur over the exterior surface. Flames should not reach the top of the test specimen.
  - 2) Damage to the Insulation Board should not extend to the outer edges of the test specimen.
- c. ASTM E 119 Standard Methods of Fire Tests of Building Construction and Materials. Results: the fire resistance rating of a wall assembly shall not be reduced by the addition of the Outsulation System.
- d. Multi-Story Fire Test (Full Scale, End Use Configuration Test) UBC 17-6. Results: assembly shall resist major vertical flame spread, major flame spread on surface and lateral flame spread.
- e. ULC-S101 Type Exposure (Diversified Fire Test). Results: Outsulation System shall remain in place for 15 minutes. No through openings or tears occurred in the exposed surface.
- f. Factory Mutual Corner Test (Full Scale, End Use Configuration Test). Results: flame propagation limited to immediate fire exposure area. Maximum propagation at ceiling of 12' from corner.

#### 1.06 SUBMITTALS

#### A. Samples:

- 1. The Applicator shall submit to the Designer two 2' (610mm) x 4' (1220mm) samples of the Outsulation System for each finish, texture, and color to be used on the project. The same tools and techniques proposed for the actual installation shall be used. The MEPS shall be mounted on the appropriate substrate using the appropriate adhesive. If the substrate is masonry or brick, the samples may be mounted on gypsum sheathing.
- 2. For panelized installation, an additional sample, per (1) above, shall be retained by the panel fabricator.
- 3. One of the Designer's samples shall remain at the job site for use in comparing the approved appearance to that being applied.
- B. Shop Drawings: Complete drawings prepared by the Panel Fabricator showing wall layout, all details, connections, expansion joints, the Outsulation System and installation sequence shall be submitted to the Designer for the panelized Outsulation System.
- C. Reports: Copies of selected test reports by independent laboratories verifying the performance of the Outsulation System shall be submitted to the Designer by the Applicator when requested.

#### 1.07 QUALITY ASSURANCE

#### A. Qualifications:

- 1. System Manufacturer: Shall have manufactured exterior insulation and finish systems in the United States for at least 10 years, shall have completed at least 20,000 projects utilizing this exterior insulation and finish system, and shall be a member of EIMA (Exterior Insulation Manufacturers Association).
- 2. Applicator: Shall be knowledgeable in the proper installation of the Dryvit Outsulation System and shall be experienced and competent in the installation of exterior insulation and finish systems generally.
- 3. Panel Fabricator: Shall be an Applicator experienced and competent in the fabrication of architectural wall panels and shall employ the proper equipment and manpower to fabricate such panels.
- 4. Panel Erector: Shall be the panel fabricator, or approved by and under the direct supervision of the panel fabricator and shall be experienced and competent in the installation of architectural wall panel systems and shall employ the proper equipment and manpower to install such panels.
- 5. Insulation Board Manufacturer: Shall be accepted by Dryvit as capable of producing the MEPS in accordance with current Dryvit specifications (DS131) and shall subscribe to the Dryvit Third Party Certification and Quality Assurance Program.
- 6. Sealant Contractor: Shall be experienced and competent in the installation of high performance industrial and commercial sealants.

#### B. Regulatory Requirements:

- 1. The MEPS shall be separated from the interior of the building by a minimum 15-minute thermal barrier.
- The use of and maximum thickness of MEPS shall be in accordance with the applicable building codes.

#### C. Approvals, Listings and Classifications:

1. The surface burning characteristics of the MEPS shall be classified by Underwriters Laboratories and be listed in the U.L. Building Materials Directory as having a flame spread and smoke development rating of not greater than 25 and 450 respectively. These numerical flame spread and smoke develop-



- ment ratings do not necessarily reflect the performance of this or any other material under actual fire conditions.
- 2. The Outsulation System shall be recognized by the following Model Bullding Code Organizations as described in the current versions of the documents:
  - a. BOCA Research Report No. 89-63.
  - b. ICBO Research Committee Report No. 2728.
  - c. SBCCI Compliance Report No. 8912.
- 3. The Outsulation System shall have been issued an approval as described in the current applicable HUD Materials Release.
- 4. The Outsulation System shall meet the criteria set forth in the Health and Human Services Technical Bulletin No. 30.
- 5. The Outsulation System shall be approved for use on this project by the applicable state and/or building code authorities.
- 6. The Outsulation System shall be approved by Factory Mutual Research Corporation and listed in the FM Approval Guide.

#### 1.08 DELIVERY, STORAGE AND HANDLING

- A. All Dryvit materials shall be delivered to the job site in the original, unopened packages with labels intact. Upon arrival, materials shall be inspected for physical damage, freezing, or overheating and Dryvit informed of any discrepancies. Questionable materials shall not be used.
- B. All Dryvit materials at the job site shall be stored in a cool, dry location, out of direct sunlight, protected from weather and other damage. Refer to Dryvit Product Sheets for storage temperature requirements. 1.09 JOB CONDITIONS
  - A. Existing Conditions: The Applicator shall have access to electric power, clean water, and a clean work area at the location where the Dryvit materials are to be installed.
  - B. Environmental Conditions:
    - The ambient air and wall temperature on both sides of the wall shall be minimum 40°F (4°C) or 45°F (7°C) as applicable at the time of installation of the Dryvit materials. Refer to Dryvit Product Sheets for specific product temperature requirements. The temperature shall remain so for at least 24 hours thereafter or longer if necessary for the material to be sufficiently dried.

#### C. Protection:

- Adjacent areas/materials shall be protected from damage, drops, and spills during the application of the Dryvit materials.
- 2. The Dryvit materials shall be protected by permanent or temporary means from weather and other damage prior to, during, and immediately after application. Care must be taken to prevent condensation and/or heat buildup when using tarp or plastic to prevent damage to the Outsulation System or products.
- D. Sequencing and Scheduling:
  - 1. Installation of the Outsülation System shall be coordinated with the other construction trades,
  - 2. Sufficient manpower and equipment shall be employed to ensure a continuous operation, free of cold joints, scaffold lines, texture variations, etc.

#### 1.10 LIMITED MATERIALS WARRANTY

A. Dryvit shall offer a written Limited Materials Warranty upon receipt of a properly executed Warranty Request and Completed Project Form.

#### 1.11 DESIGN RESPONSIBILITY

A. It is the responsibility of both the specifier and the purchaser to determine if a product is suitable for their intended use. The Designer selected by the purchaser shall be responsible for all decisions pertaining to design, detail, structural capability, attachment details, shop drawings, and the like. Dryvit has prepared guidelines in the form of specifications, application details, and product sheets to facilitate the design process only. Dryvit is not liable for any errors or omissions in design, detail, structural capability, attachment details, shop drawings, or the like, whether based upon the information prepared by Dryvit or otherwise, or for any changes which purchasers, specifiers, Designers, or their appointed representatives may make to Dryvit's published comments.

#### 1.12 MAINTENANCE

- A. Maintenance and repair shall follow the procedures noted in Dryvit publication DS204.
- B. All Dryvit products are designed to be virtually maintenance free. However, as with all building products, depending on location, some cleaning may be required. See Dryvit publication DS152 on Cleaning & Recoatina.

#### PART II - PRODUCTS

#### 2.01 GENERAL

A. All components of the Outsulation System shall be supplied by and obtained from Dryvit or its authorized distributors. Substitutions or additions of other materials will void the warranty.



#### 2.02 COMPONENTS

#### A. Adhesives:

- 1. Primus/Adhesive: An acrylic base, field-mixed one-to-one by weight with Portland cement for use on substrates as outlined in Section 1.05 C.5.d.
- 2. ADEPS Adhesive: A fully formulated water-based acrylic copolymer.
- 3. Mechanical Fasteners: Refer to Dryvit publication DS135 for specifications and application Instructions.
- B. Insulation Board: Aged, molded expanded polystyrene board with a nominal density of 1.0 pcf meeting the current published specifications of Dryvit's DS131.
- C. Drivit Reinforcing Meshes:
  - Standard Mesh: Glass fiber mesh used to reinforce wall areas, special shapes and irregular details.
     Shall weigh a minimum of 4.3 oz./sq. yd. and have a minimum tensile strength of 150 lbs./inch of width.
     Shall provide a relative Impact resistance of 1.0.
  - 2. Standard Plus Mesh: Mesh used for normal impact resistance. Shall weigh a minimum of 6 oz./sq. yd. and have a minimum tensile strength of 200 lbs./inch of width. Shall provide a relative impact of 2.5.
  - 3. Intermediate Mesh: Used for moderate impact resistance. Shall weigh a minimum of 12 oz./sq. yd. and have a minimum tensile strength of 300 lbs./inch of width. Shall provide a relative impact of 5.
  - 4. Panzer 20 Mesh: Used where high impact resistance is needed. Shall weigh a minimum of 20.5 oz./sq. yd. and have a minimum tensile strength of 550 lbs./inch of width. Shall provide a relative impact resistance of 15 with Standard and 25 with Standard Plus.
  - 5. Corner Mesh: Used for additional impact resistance at corners. Shall weigh a minimum of 7.2 oz./sq.yd. and have a minimum tensile strength of 540 lbs./inch of width.

#### D. Finish:

- 1. Shall be a factory-mixed, water-based acrylic coating with integral color and texture.
  - a. Quarzputz: Coarse texture.
  - b. Sandblast: Medium texture.
  - c. Freestyle: Fine texture.
  - d. Metallic: Quarzputz, Sandblast, Freestyle with a metallic sheen.
  - e. Sandpebble: Pebble stucco texture.
- 2. Shall be a factory-mixed, water-based acrylic coating utilizing a colored stone aggregate.
  - a. Carrara: Natural color marble aggregate.
  - b. Bed-Rok: Natural stone exposed aggregate.
  - c. Stone Mist: Ceramically colored, quartz aggregate.
  - d. Quarzite: Ceramically colored, quartz aggregate.

#### E. Primers and Sealers:

- 1. Color Prime: A water-based, pigmented, acrylic primer.
- 2. Prymit: A water-based acrylic primer/adhesion promoter.

#### F. Coatings:

- 1. Demandit: A non-textured water-based acrylic coating.
- 2. Rewvit: A fine textured water-based acrylic coating.

#### 2.03 MATERIALS

- A. Portland Cement: Type I, I-II or II, meeting ASTM C 150, white or gray in color, fresh and free of lumps.
- B. Water: Clean and free of foreign matter.

#### 2.04 EQUIPMENT

- A. All mixing shall be done with a CLEAN Goldblatt Jiffler Mixer #15311H7 or equivalent, powered by a 1/2" (13mm) drill or equivalent at 400-500 rpm.
- B. A high-speed wood router and proper bit(s).
- C. Hand tools associated with the plastering trade.
- D. For panelized installations, such equipment as necessary for construction and attachment of prefabricated wall panels.

#### PART III - EXECUTION

#### 3.01 INSPECTION

- A. Examination of Substrate:
  - 1. Prior to installation of the Outsulation System, it is the Applicator's responsibility to ensure the substrate:
    - a. Is of a type listed in Section 1.05 C.5.d.
    - b. Meets dimensional tolerances per Section 1.05 C.4.
    - c. Surface is free of foreign materials such as oil, dust, dirt, form-release agents, paint, wax, water repellents, moisture, frost, etc.
    - d. Is sound, connections are tight, there are no surface voids or projections, etc.
    - e. Is in compliance with other Contract Documents.
  - 2. The Designer and general contractor shall be advised of all discrepancies in writing. Work shall not proceed until unsatisfactory conditions are corrected.



#### 3.02 SYSTEM INSTALLATION

#### A. General:

- 1. Refer to DS204 for detailed application instructions.
- B. Mixing and Preparation:
  - 1. Primus/Adhesive:
    - a. Shall be stirred to a homogeneous consistency before mixing. Refer to Dryvit publication DS414 for specific instructions.
    - b. In a clean container, thoroughly mix the Primus/Adhesive with Portland cement at a 1-to-1 ratio by weight. Allow the Mixture to set for 5 minutes. Re-temper, adding a small amount of water to achieve desired workability. The Mixture shall be used immediately after tempering.
    - c. No additives shall be added under any circumstances.
  - 2. ADEPS Adhesive: Use directly from the pail without mixing. No additives, including water, shall be added. Refer to Dryvit publication DS407 for specific instructions.

#### C. Insulation Board:

- 1. General:
  - a. Shall be applied to the substrate starting from the bottom of the wall with its long edge oriented horizontally, in a running bond pattern with joints offset with respect to substrate joints.
  - b. Shall be supported by temporary means.
  - c. Shall be staggered and interlocked at corners.
  - d. Shall be precut to fit openings, corners and projections prior to application of the adhesive. NOTE: Board edges shall not align with corners of wall openings.
  - e. The "Ribbon and Dab" or the "Notched Trowel" method of adhesive application may be used. Refer to local building codes and national evaluation reports.
  - f. Refer to Dryvit publication DS204 for further instructions.
- 2. Adhesive Application:
  - a. Primus/Adhesive Mixture:
    - 1) Ribbon and Dab Method: Ribbons of adhesive shall be applied to the perimeter of one face of the MEPS. The adhesive shall not be applied to the edges of the MEPS. Eight dabs of adhesive shall be applied to the area within the ribbon. A minimum of 32% of the MEPS face shall be in contact with the adhesive.
    - 2) Notched Trowel Method: Adhesive shall be applied to one face of the MEPS using a notched trowel. Ribbons of adhesive shall be applied to the perimeter of the MEPS. Adhesive shall not be applied to the edges of the MEPS.
    - 3) Push Box Method: Application by this method shall be in accordance with Dryvit's Application Bulletin No. 81-2.
  - b. ADEPS Adhesive: The adhesive shall be applied directly to one face of the MEPS using a notched trowel. Refer to Dryvit publication DS143 for further instructions.
- 3. The prepared MEPS shall be immediately applied to the substrate as follows:
  - a. Lightly affix the MEPS to the substrate with the lower horizontal edge and adjacent vertical edge 1/2" (13mm) from adjacent boards or its final position on the substrate.
  - b. Press down and slide diagonally into place or until it tightly abuts the edges of adjacent boards. Continue for all MEPS boards.
  - c. The entire outside face of the MEPS shall be tamped with even pressure to ensure complete contact of the adhesive to the substrate and that all boards are in the same plane. A straight edge at least 6' (1.8m) long shall be used for this purpose.
  - d. If gaps occur, slivers of MEPS shall be cut and shaped to fit the gaps and shall be inserted without using adhesive.
  - e. A minimum of 24 hours shall be allowed for the adhesive to form a positive bond. The MEPS shall not be moved while the adhesive is curing. Low temperatures and/or high humidity conditions may require longer curing time for ADEPS. Refer to Dryvit publication DS407.
- D. Base Coat Systems:
  - 1. Inspection Before Application:
    - a. The face of the MEPS shall be inspected as follows:
      - 1) For flatness, using a minimum 6' straight edge, high areas and out-of-plane board joints shall be sanded flat; low areas shall <u>not</u> be built up with Primus/Adhesive Mixture to form a flat surface.
      - 2) For damage and foreign materials, deficiencies shall be corrected.
      - 3) For deterioration due to weathering or U/V, visible as discoloration, affected areas shall be sanded to remove deterioration while maintaining the flatness of the surface.
    - b. The minimum remaining thickness of MEPS at any point behind a reveal (groove) or other feature shall be 3/4" (19mm).
    - c. Foam shapes, if used, shall be applied directly to the substrate or face of the MEPS.



- 2. Base Coat System: For Standard Mesh, Standard Plus Mesh, or Intermediate Mesh.
  - a. Using a stainless steel trowel, the Primus/Adhesive Mixture shall be applied to the surface of the MEPS to a uniform thickness of approximately 1/16" (1.6mm).
  - b. The Mesh shall be immediately embedded into the wet Primus/Adhesive Mixture with its concave surface to the wall to reduce its tendency to curl. The surface shall then be smoothed with a trowel, working from the center toward the edges, until the bare Mesh is fully covered and not visible. NOTE: The final approximate thickness of the base coat shall be sufficient to fully embed the Mesh but shall not exceed 3/32" (2.4mm). A slight mesh pattern may be visible upon drying.
  - c. The Mesh shall be lapped a minimum of 2 1/2" (64mm) on all sides.
  - d. A minimum of 24 hours shall be allowed for the base coat to cure. The base coat shall be protected from damage and weather while curing.
  - e. All MEPS edges at openings, penetrations, or other termination points, shall be backwrapped.
- 3. Double Mesh Base Coat System:
  - a. Double layers of Standard Plus Mesh may be used for local reinforcing only. The first Mesh layer shall be installed per Section 3.02 D.2.
  - b. The surface of the first Mesh layer shall be examined after curing for projections, loose strands, etc. and corrected to produce a flat face.
  - c. The second Mesh layer shall be applied in the same manner as the first layer. The lapped edges of the Mesh in the two layers shall be offset.
- 4. Panzer 20 Mesh Base Coat System:
  - a. Sufficient Primus/Adhesive Mixture shall be applied to the face of the MEPS to a uniform thickness. Final thickness is not to exceed 1/8" (3.2mm).
  - b. The Panzer 20 Mesh shall be immediately embedded into the wet Primus/Adhesive Mixture, working from the center toward the edges. The surface shall then be smoothed until the Mesh is fully covered and not visible. The approximate thickness of the base coat shall not be excessive but sufficient to fully cover the Mesh.
  - c. Edges of adjacent Panzer 20 Mesh pieces shall be tightly butted. Panzer 20 mesh pieces shall not be lapped.
  - d. A minimum of 24 hours shall be allowed for this layer of the base coat to cure. The base coat shall be protected from damage and weather while curing.
  - e. The surface of the Panzer 20 layer shall be examined after curing for projections, loose strands, etc. and corrected to produce a flat surface.
  - f. A second layer consisting of Primus/Adhesive Mixture and Standard or Standard Plus Mesh shall be applied over the Panzer 20 Mesh layer per Section 3.02 D.2 above.
  - g. Details of the Panzer 20 Mesh base coat system at the ends of the walls, windows, panel edges, corners, etc. shall be in accordance with Dryvit's current published Pocket Guide, DS204.

#### E. Drwit Finish Application:

- 1. General:
  - a. After stirring to a homogeneous consistency, the Finish shall be applied to the entire wall surface in a continuous application.
  - b. Finish shall be trowel or spray-applied per manufacturer's application instructions.
  - c. Finish shall be protected from airborne contamination such as dust, soot, etc. and from weather and other damage until fully dried.
  - d. No additives shall be added under any circumstances. Refer to the appropriate Dryvit finish publication for further application instructions.
- 2. Quartzputz, Sandblast, Metallic, Sandpebble:
  - a. A tight coat shall be applied to the base coat. When trowel-applied, leveling and texturing shall take place in one operation.
  - b. The maximum thickness shall be no greater than that of the largest aggregate for Quarzputz and Sandpebble. The thickness shall be approximately 1 to 1 1/2 times the thickness of the largest aggregate for Sandblast.
- 3. Freestyle:
  - a. Shall be applied to the Base Coat and leveled, then textured in one operation.
  - b. The texture shall match the approved sample.
  - c. The maximum thickness shall be 1/4" (6.4mm).
  - d. The minimum thickness shall be 1/16" (1.6mm).
- 4. Carrara:
  - a. Color Prime shall be brushed, rolled, or spray-applied to the approved substrate and allowed to dry prior to application of Carrara.
  - b. Prep shall be rolled or trowel-applied to the substrate immediately prior to application of Carrara.
  - c. Refer to Dryvit publication DS140 for mixing and application instructions.

PACE 6-27
Date of Issuance: July 9, 1991



- 5. Bed-Rok:
  - a. Refer to Dryvit publication DS141 for mixing and application instructions.
- 6. Stone Mist:
  - a. Two coats shall be spray-applied to the Base Coat. Allow one hour drying time between coats.
  - b. Refer to Dryvit publication DS420 for mixing and complete application instructions.
- 7. Quarzite:
  - a. Color Prime shall be brushed, rolled or spray-applied to the approved substrate and allowed to dry prior to the application of Quarzite.
  - b. Apply and level Quarzite to a thickness of approximately 1 1/2 times the size of the aggregate (1/16" to 3/32").
  - c. Refer to Drytt publication DS429 for mixing and application instructions.

#### 3.03 FIELD QUALITY CONTROL

- A. Dryvit assumes no responsibility for on-site inspections. Dryvit Systems, Inc. and/or its distributors will provide field service support if reasonably requested by the Applicator. The Designer, general contractor, or their appointed representative and/or the Dryvit distributor should make periodic on-site inspections to ensure that the Dryvit materials are being installed in strict accordance with Dryvit's specifications. The Applicator shall be responsible for the proper application of the Dryvit materials.
- B. If requested, the Applicator shall certify in writing the quality of work performed relative to the substrate system, details, installation procedures and workmanship.
- C. If requested, the MEPS supplier shall certify in writing that the MEPS meets Dryvit's specifications.
- D. If requested, the sealant applicator shall certify in writing that the sealant application is in accordance with the sealant manufacturer's and Dryvit's recommendations.

#### 3.04 CLEAN-UP

- A. Materials left over by the Applicator and/or Panel Erector at the job site shall be removed by either the Applicator or the Panel Erector.
- B. The Panel Erector and/or the Applicator shall clean adjacent materials and surfaces and the work area of foreign materials resulting from their work.

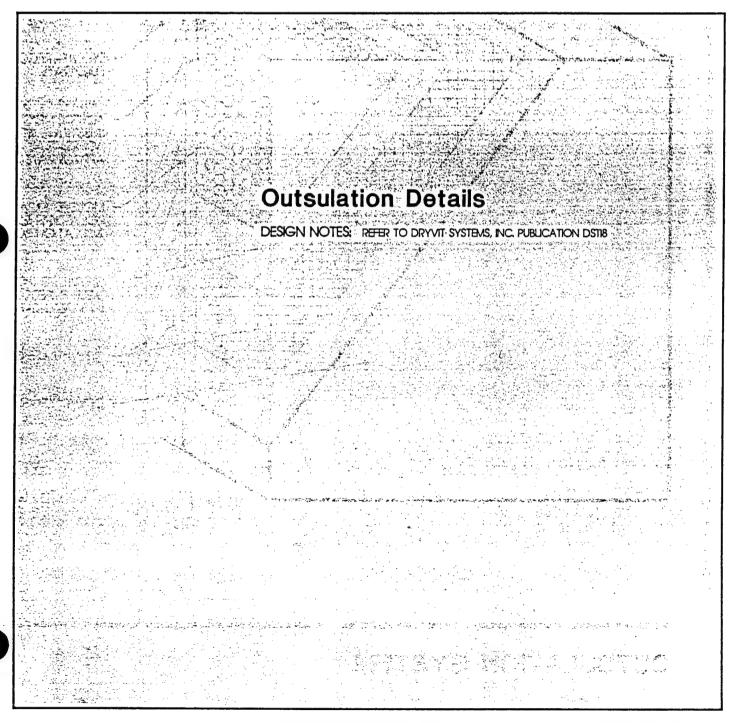






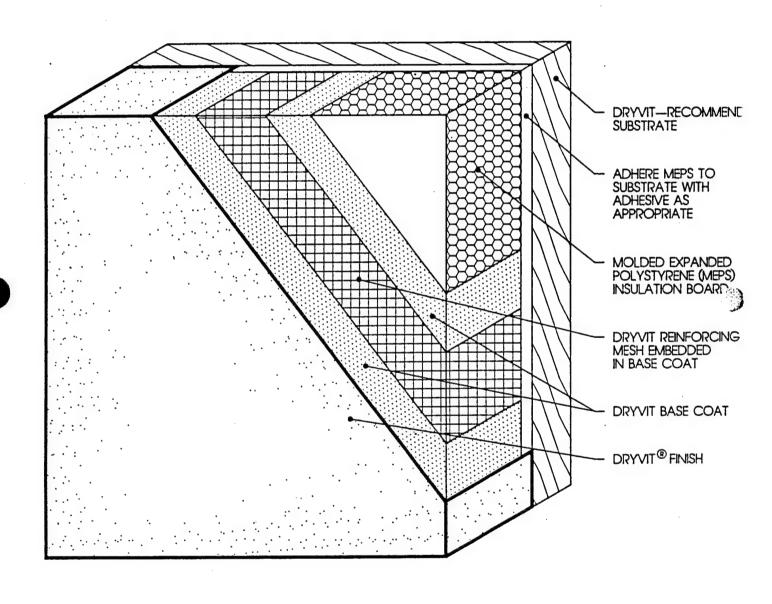
AN EXTERIOR WALL INSULATION AND FINISH SYSTEM







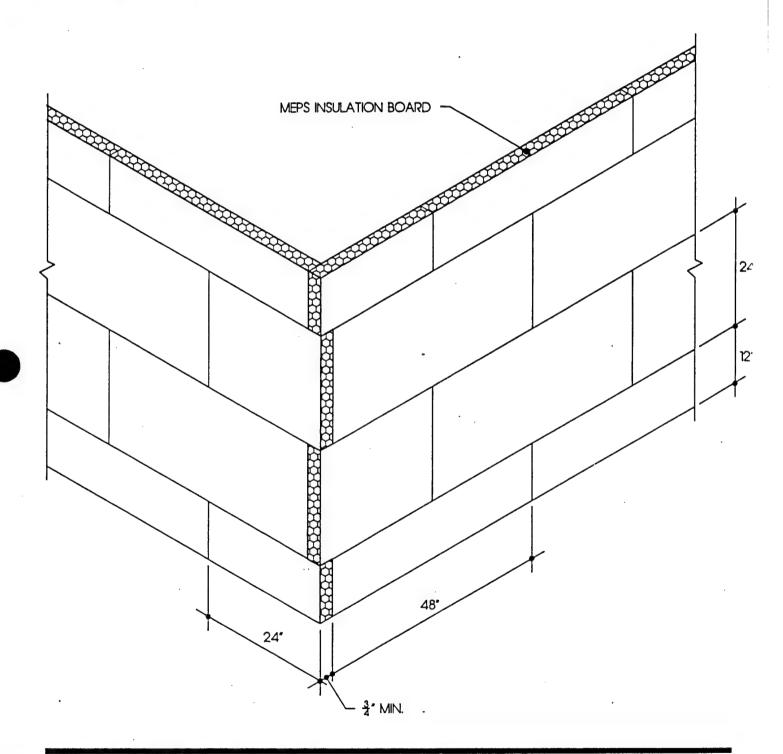




#### **OUTSULATION SYSTEM**



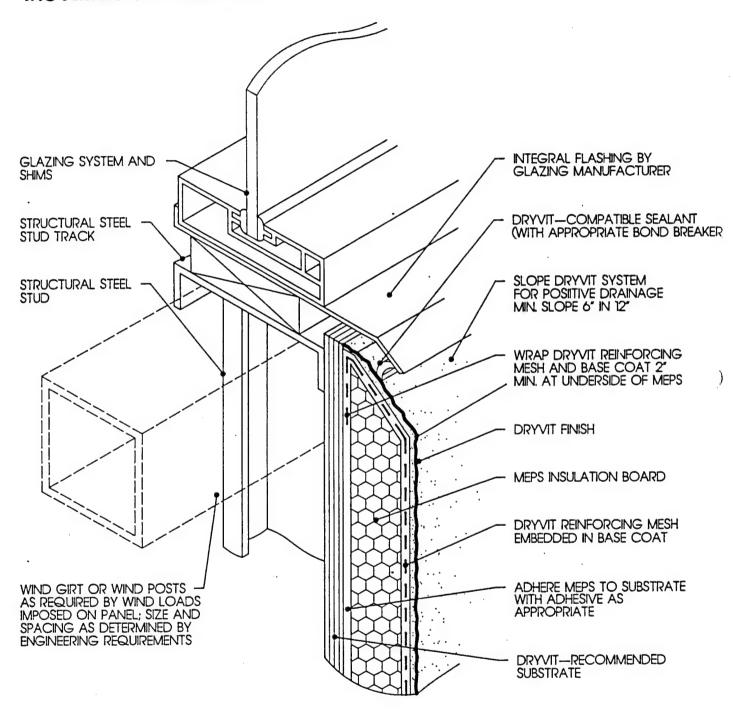




INSULATION BOARD/LAYOUT





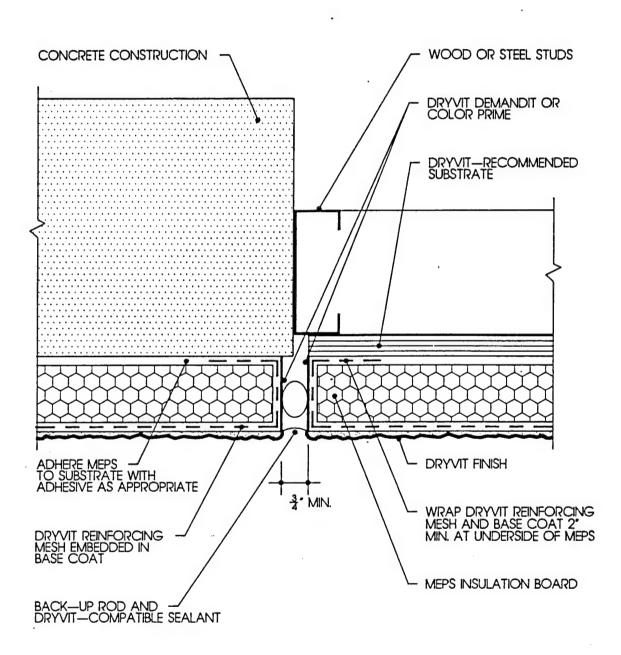


WINDOW SILL/ALUMINUM FRAME WITH INTEGRAL FLASHING



# dryvit Q

#### Installation Details

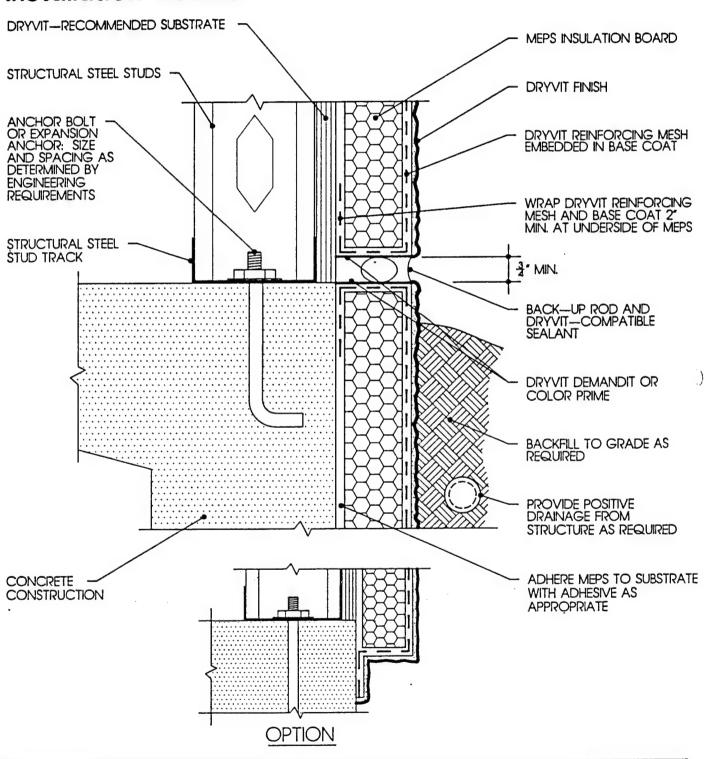


DRYVIT SYSTEM/EXPANSION JOINT DISSIMILAR MATERIALS



# dryvit 3

#### Installation Details



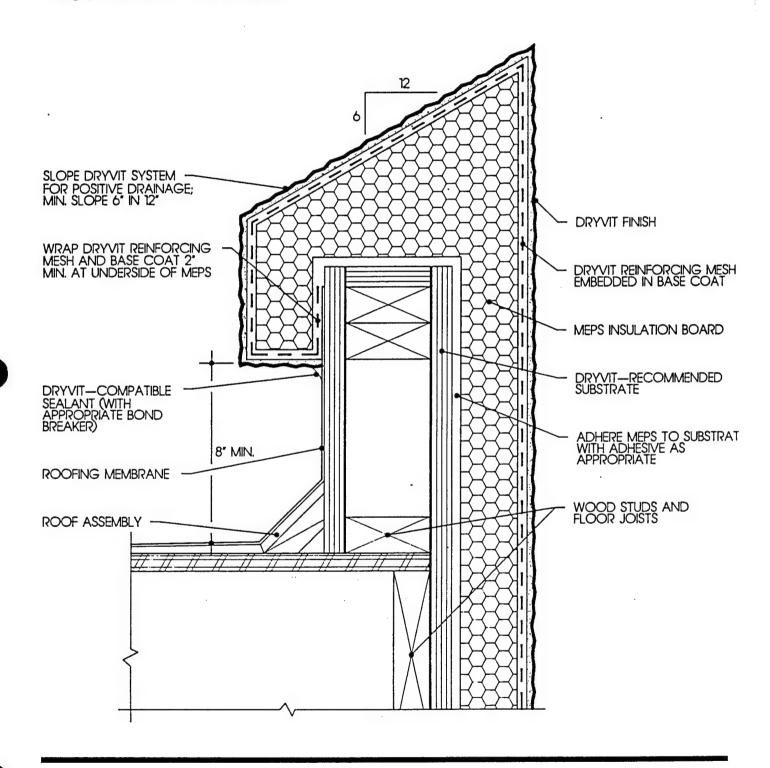
GRADE LEVEL/LIGHT GAUGE EXPANSION JOINT FRAMING AT CONCRETE SLAB

DRYVIT SYSTEMS, INC. HEADQUARTERS ONE, ENERGY WAY WEST WARWICK, RI O2893



# dryvit 1

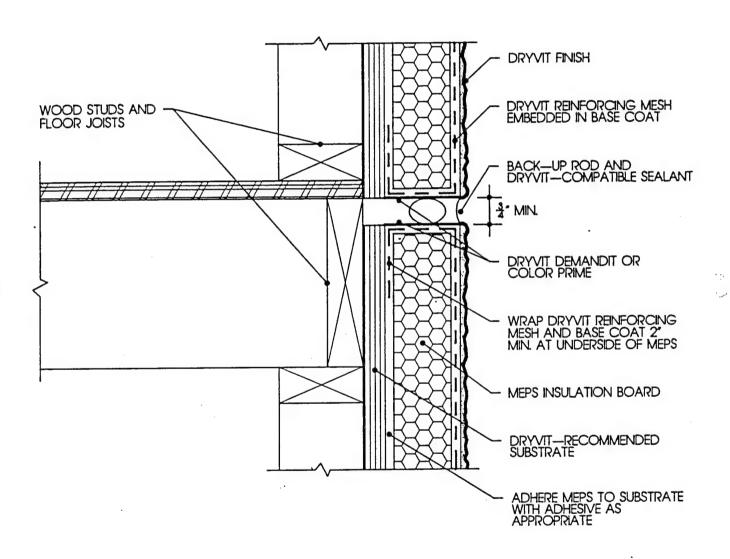
#### Installation Details



ROOF LEVEL/WOOD FRAMING MEPS PARAPET CAP



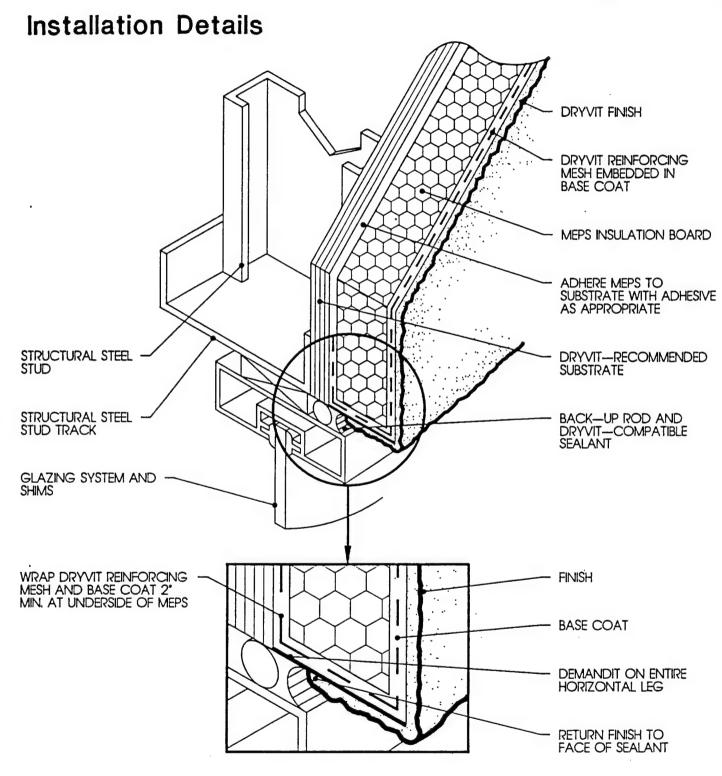




## INTERMEDIATE LEVEL/WOOD FRAMING EXPANSION JOINT AT FLOOR LEVEL



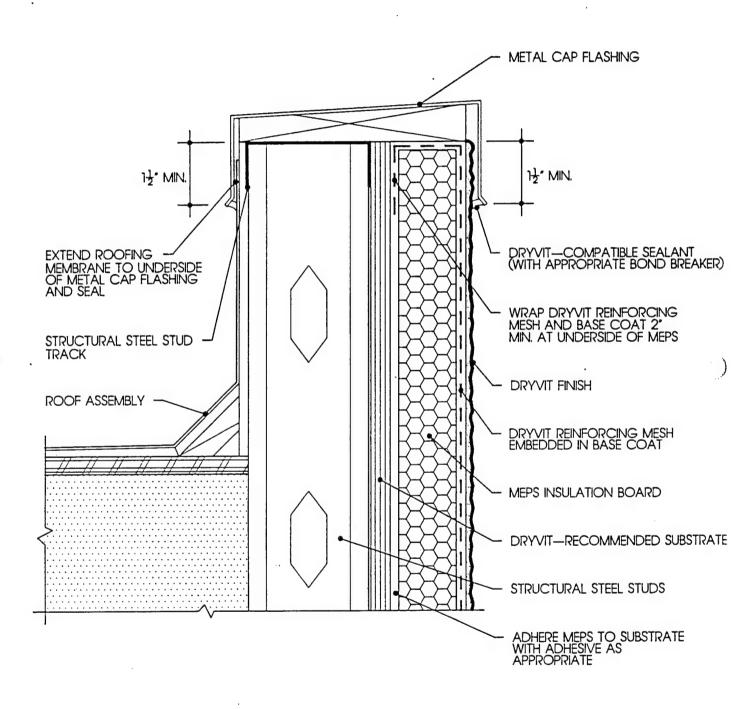




#### WINDOW HEAD/ALUMINUM FRAME



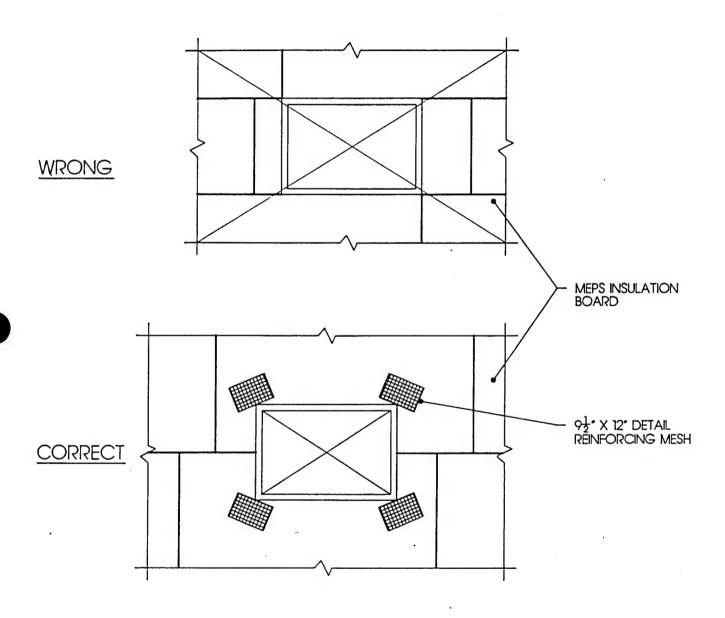




## ROOF LEVEL/LIGHT GAUGE FRAMING METAL PARAPET CAP FLASHING







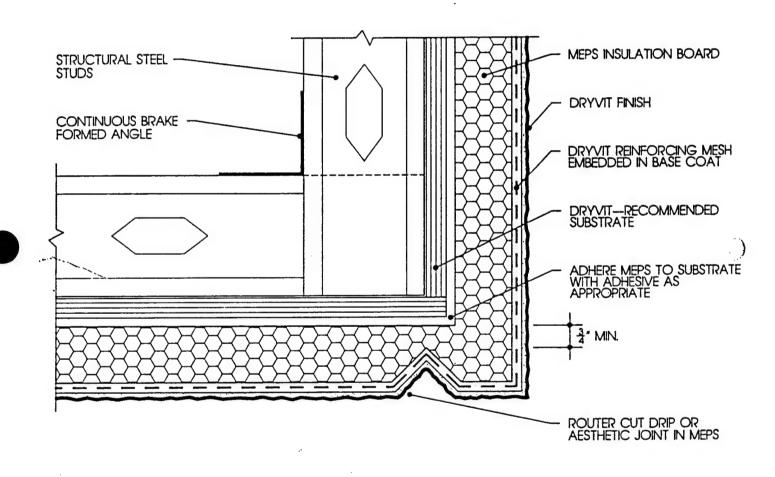
NOTES: 1. LOCATE INSULATION BOARDS SUCH THAT EDGES DO NOT ALIGN WITH CORNERS OF PENETRATION.

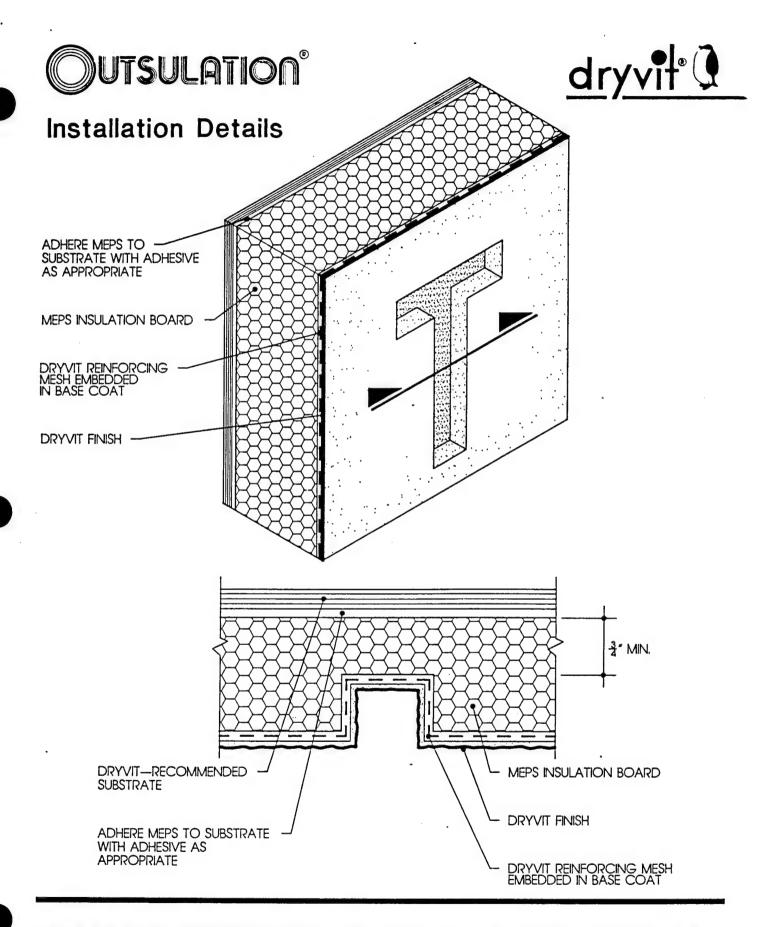
2. APPLY A PIECE OF  $9\frac{1}{2}$ " X 12" DETAIL REINFORCING MESH DIAGONALLY AT EACH CORNER.

#### WALL PENETRATIONS





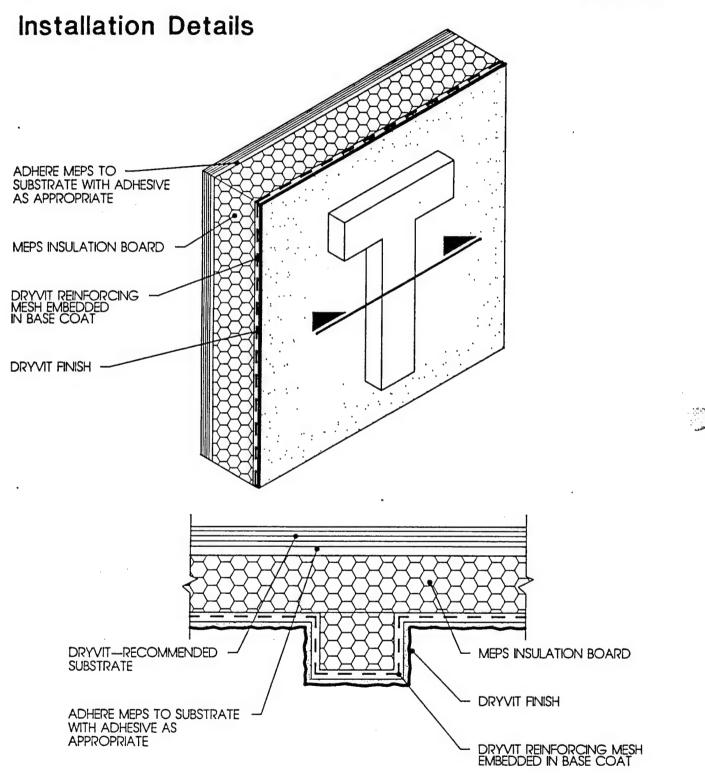




#### GRAPHICS RECESSED IN OUTSULATION SYSTEM







#### GRAPHICS APPLIED TO OUTSULATION SYSTEM

DRYVIT SYSTEMS, INC. HEADQUARTERS ONE BHERGY WAY WEST WARWOOK, RI O2893





METAL OR WOOD STUDS

ADHERE MEPS TO METAL LATE WITH ADHESIVE

DRYVIT REINFORCING MESH EMBEDDED IN BASE COAT

MEPS INSULATION BOARD

DRYVIT FINISH

2.5 OR 3.4 LBS./SQ.YD. SELF—FURRING, GALVANIZED EXPANDED METAL LATH

ATTACH METAL LATH TO STRUCTURAL FRAMING USING

APPROPRIATE FASTENERS APPROVED SUBSTRATE DRYVIT FINISH DRYVIT REINFORCING MESH EMBEDDED IN BASE COAT MEPS INSULATION BOARD ADHERE MEPS TO METAL LATH WITH ADHESIVE

BRICK, MASONRY OR CONCRETE CONSTRUCTION

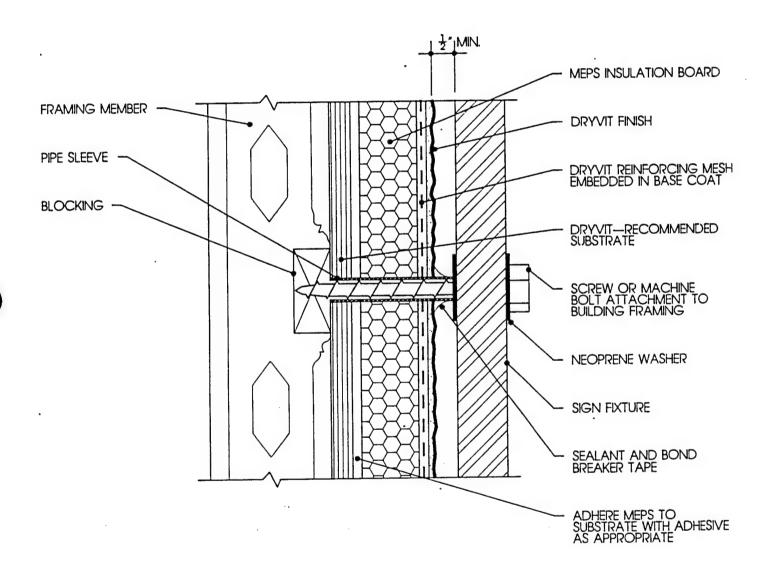
> ATTACH METAL LATH TO MASONRY WALL USING APPROPRIATE FASTENERS OR ANCHORS

2.5 OR 3.4 LBS./SQ.YD. SELF—FURRING, GALVANIZED EXPANDED METAL LATH

#### METAL LATH AS A SUBSTRATE







NOTE: ENTIRE PERIMETER OF PIPE SLEEVE IS CAULKED TO PREVENT WATER ENTRY INTO WALL.

#### SIGN ATTACHMENT

# OUTSULATION® THE FACTS: Testing

As the pioneer and acknowledged leader of the EIFS industry, Dryvit Systems, Inc. has always considered stringent testing of key importance to quality performance.

Outsulation has been subjected to testing well beyond code minimums at national testing laboratories as well as at Dryvit's own research, technology and

manufacturing facilities — unparalleled in the industry. The data provided on the following pages will convince you that Dryvit Systems demonstrates a full commitment to excellence in both product and performance. Such a commitment offers extraordinary peace of mind to the architect and developer specifying

Outsulation. And only Dryvit Outsulation can show over 20 years of proven application results in North America — a total of 95,000 buildings, both new and retrofit construction. Dryvit products are designed to minimize upkeep. However, as with all building products, normal maintenance and cleaning are required.

TEST	METHOD	RESULTS
STRUCTURAL TESTING  Positive and Negative Windloads	ASTM E-330	Tested to pressures in excess of 180 psf without loss of bond to the substrate.
MIL STANDARDS  Mildew/Fungus Resistance	810B	Passes.
ASTM		
☐ Salt Spray Resistance	B-117	300 hours. No deleterious effects.
☐ Water Vapor Transmission	E-96 Water Method Procedure "B"	Not more than 15 grains an hour per square foot.
☐ Abrasion Resistance	D-968	500 liters. No deleterious effects.
☐ Accelerated Weathering	G-53	2000 hours. No deterioration.
☐ Impact Resistance	E-695	Panzer 20 Mesh 6"-0" drop height. No surface cracking.
,	EIMA Test Standard 101.86	Standard™ Mesh > 25 inlbs. Standard Plus™ Mesh > 50 inlbs. Intermediate® Mesh > 90 inlbs. Panzer & Standard Mesh > 150 inlbs



TEST	METHOD	RESULTS
FEDERAL TEST METHOD S  Absorption — Freeze/Thaw	FIANDARD 141A  Panels soaked in water @ 20°C for 4 days, then placed at -10°C for 2 hours and +20°C for 2 hours.	,
INSULATION BOARD		
☐ Thermal Conductivity	ASTM C-177	"K" Factor — 0.26 maximum at 40 0.28 maximum at 75
□ Average Density	ASTM D-1622	1.0 lb./cu. ft. average
☐ Compressive Strength	ASTM D-1621	10 psi at 10% offset
☐ Coefficient of Expansion	ASTM D-696	3.5 x 10 <sup>-5</sup> in./in./Degree F
☐ Water Vapor Transmission	ASTM E-96	1.6 perm — inch minimum
□ Water Absorption	ASTM C-272	By volume — 2.5% maximum
☐ Fire Hazard Classification	ASTM E-84	Flame spread ≤ 25° Smoke developed ≤ 450°
☐ Oxygen Index	ASTM D-2863	24.0 minimum
FIRE TESTING* — SUMM/ (See further details on pages 4 and 5)	ARY .	•
□ "Tunnel Test" (Underwriter's Laboratories, Inc.)	UL-723 (ASTM E-84)	Flame Spread ≤ 25° Smoke Developed ≤ 450°
☐ Fire Endurance Test	ULC-S 101-1977	System remained in place during a 15-minute fire exposure test.
□ Diversified Fire Test	Modified ASTM E-108	Zero Fire Hazard
□ Standard Fire Exposure Test	ASTM E-119	Fire resistance rating of one- hour and two-hour wall assemblies was not reduced by the addition of the Dryvit Outsulation System.
□ Full Scale Multi-Story Fire Test	UBC 17-6 1250# crib — Independent Research Laboratory San Antonio, Texas	No lateral spread of flame from compartment of fire origin to adjacent spaces.

• These numerical Flame Spread and Smoke Development ratings do not necessarily reflect the performance of this or any other material

# **OUTSULATION®**THE FACTS: Fire Testing

#### **TEST**

#### **DESCRIPTION**

#### TUNNEL TEST ASTM E-84

The Outsulation coating system has been tested by National Laboratory in accordance with UL-723 (ASTM E-84) test procedure. The coating system demonstrated resistance to flame spread, achieving a flame spread of less than 25°. Further, the expanded

polystyrene insulation used within the Outsulation System has a flame spread rating of less than 25° when tested in accordance with the ASTM E-84 procedure.

#### FIRE ENDURANCE TEST ULC-S 101-1977

The Dryvit Outsulation exterior wall insulation and finish system remained in place during a 15-minute fire exposure test conducted in conformance with ULC-S 101-1977 (ASTM E-119)

"Standard Methods of Fire Endurance Tests of Building Construction and Materials."

#### DIVERSIFIED FIRE TEST UNIVERSITY OF CALIFORNIA MODIFIED ASTM E-108

A series of fire tests involving a modified ASTM E-108 procedure have been conducted at the University of California. The tests were conducted on Outsulation panels having expanded polystyrene insulation ranging from 2½" to 8" thickness. The tests were conducted to simulate the exposure delivered to the exterior face of a building resulting from a fully developed room fire which "vents" to the outside through a window.

In Paragraph 7.4 of the Analysis and Conclusions of the report, it is noted "there was very little evidence to indicate that any significant burning or flaming had occurred beneath the protective coating." Subsequent to test, Dr. Robert Brady Williamson offered additional observations in a letter dated September 16, 1976. The letter indicates smoke production during tests of Outsulation panels was limited.

# STANDARD FIRE EXPOSURE TEST ASTM E-119

The Dryvit Outsulation System has been evaluated by ASTM E-119 testing with one-hour and two-hour wall assemblies. The test exposes a test specimen to a standard fire exposure controlled to achieve specified temperatures throughout a specified time period and measures its response to the exposure in terms of the transmission of temperature and hot gases

through the assembly.

The fire resistance rating, as determined by ASTM E-119 of listed one-hour and two-hour wall assemblies, was not reduced by the addition of the Dryvit exterior wall insulation system. The wall assembly was tested with both the exterior and interior face exposed to the fire.

<sup>\*</sup>These numerical Flame Spread and Smoke Development ratings do not necessarily reflect the performance of this or any other material under actual fire conditions.



#### **TEST**

#### **DESCRIPTION**

# UBC 17-6 FULL SCALE MULTI-STORY FIRE TEST 1250 POUND CRIB

The flammability characteristics of Outsulation panels using 4" of expanded polystyrene were evaluated in a full scale fire test involving a two-story structure. The test was conducted at an independent research aboratory in San Antonio, Texas.

The panels were subjected to a fire exposure from a 1250 pound crib which was designed to simulate the ASTM E-119 standard time/temperature curve for a minimum of 30 minutes. The crib was allowed to burn freely for approximately 40 minutes. Temperatures exceeded 900°F on the face of

January, 1980

(Date)

the panels for the majority of the test.

In spite of this severe fire exposure, the Outsulation panels demonstrated significant resistance to flame propagation. Test conclusions show that there was no flame penetration into the second floor area during the test. There was no significant flame propagation over the exterior face of the panels. There was no lateral spread of flame from the compartment of fire origin to adjacent spaces during the test exposure.

## 

#### CONCLUSION

"Outsulation has been fire tested in configurations reflecting an end use condition. Both fire tests and actual fire experience confirm Outsulation will not affect building fire safety.

"The possibility of vertical flame spread has been carefully studied. Available data shows Outsulation using up to 8" of EPS and under pessimized test conditions will not spread flame.

"The use of Outsulation outside the building automatically minimizes concerns regarding smoke generation. Subjective analysis of smoke generated by tests conducted indoors have been made. Smoke production is limited."

### OUTSULATION° THE EACTS.

# THE FACTS: Codes and Approvals

#### CODES



ICBO UNIFORM BUILDING CODE

**Evaluation Report 2728** 



THE BOCA
BASIC/NATIONAL
BUILDING CODE

Research Report 87-12



SBCCI STANDARD BUILDING CODE

**Compliance Report 8912** 

Building code authorities are charged with developing and administering guidelines for systems and products to insure the protection of public health, safety and welfare.

Regulations affecting the Dryvit Outsulation System are found in various sections referencing building usage, type of construction, structural loads and fire performance. The insulation component of Outsulation is addressed specifically by each code as noted in the listing.

#### **APPROVALS**

- Metropolitan Dade County, Florida
- California State Fire Marshal's Office
- New York State
- City and County of San Francisco
- HUD U.S. Dept. of Housing and Urban Development
- Dept. of Health and Human Services
- City of Phoenix, Arizona
- City of Mobile, Alabama
- City and County of Denver, Colorado

- State of Connecticut
- Zoning Code of the City of Coral Gables, Florida
- City of Jacksonville, Florida
- City of Baltimore, Maryland
- State of Rhode Island
- Texas State Board of Insurance
- State of Wisconsin
- Canada Mortgage and Housing Corporation #11421
- City of New York, MEA #67-87-M
- City of Los Angeles



#### NATIONAL ACCOUNT LISTING (PARTIAL)

#### HOTEL/MOTEL

Chalet Susse International
Doubletree Inns
Hilton Hotels
Hilton Inns
Holiday Inns
Howard Johnsons
Hyatt Hotels
Marriott Corporation
Promus Companies
Quality International
Ramada Inns
Sheraton Hotels
Westin Hotels

#### **RESTAURANT & RETAIL**

Arby's Inc.
Dayton Hudson Corporation
Dillards
Hardee's Food Systems
Kentucky Fried Chicken
K-Mart
McDonalds
Montgomery Ward
Nordstroms
Sears Roebuck & Co.
Shoney's Inc.
Taco John's
Walgreens

#### **INSURANCE & FINANCIAL**

AETNA
All-State
Equitable Assurance Co.
Mass Mutual
Prudential Insurance Co.
Security Pacific Bank
State Farm
Teachers Insurance Co.
Travelers Insurance Co.

#### GENERAL CONTRACTORS GROUP

Gilbane Building Co.
Inland Construction Co.
McDevitt & Street
Morrison-Knudsen
Pepper Construction
Tishman Realty and Construction Co.
Turner Construction Co.

#### MEDICAL & CORPORATE

American Medical International Boeing Aerospace Charter Medical Corporation Coca-Cola Ford Motor Co. Hospital Corporation of America Humana IBM Kaiser Medical Toyota/Lexus

#### **REAL ESTATE DEVELOPERS**

Edward J. DeBartolo Co. Homart Development Corp. Kravco Co. Melvin Simon Corp. Opus Corp. Pyramid Companies The Rouse Co. Trammell Crow

#### GOVERNMENT

Army Corp. of Engineers Federal Bureau of Prisons HUD & FHA U.S. Armed Forces

#### GENERAL SCOPE OF WORK

FOR A

a. WATER CONSERVATION STUDY (Water and Energy), and b. LIMITED ENERGY STUDY (Glass)

FORT KNOX, KY

Performed as part of the ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP) FY94S

#### FORT KNOX, KY SCOPE OF WORK FOR A

### -a. WATER CONSERVATION STUDY (Water and Energy), and b. LIMITED ENERGY STUDY (Glass)

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- 7.2 Perform a. Water Conservation Study and b. Limited Energy Study (Glass).
  - 7.3 Reevaluate Selected Projects
  - 7.4 Evaluate Selected ECOs
  - 7.5 Combine ECOs into Recommended Projects
  - 7.6 Submittals, Presentations and Reviews

#### **ANNEXES**

- A DETAILED SCOPE OF WORK
- B EXECUTIVE SUMMARY GUIDELINE
- C REQUIRED DD FORM 1391 DATA

GLOSSARY OF ACCRONYMS

- 1. BRIEF DESCRIPTION OF WORK: The Architect-Engineer (A/E) shall:
- 1.1 Review previously completed Energy Engineering Analysis Program (EEAP) study which applies to the specific building, and/or systems, or energy conservation opportunity (ECO) covered by this study, if any had been done.
- 1.2 Perform a Limited Energy survey (glass), and Water Conservation Study of specific buildings or areas to collect all data required to evaluate the specific ECOs included in this study.
- 1.3 Reevaluate the specific project or ECO from the previous study, if any were done, to determine its economic feasibility based on revised criteria, current site conditions and technical applicability.
- 1.4 Evaluate specific ECOs to determine their energy savings potential and economic feasibility.
- 1.5 Provide project documentation for recommended ECOs as detailed herein.
- 1.6 Prepare a comprehensive report to document all work performed, the results and all recommendations.

### 2. GENERAL

- 2.1 This study is limited to the evaluation of the specific buildings, systems, or ECOs listed in Annex A, DETAILED SCOPE OF WORK.
- 2.2 The information and analysis outlined herein are considered to be minimum requirements for adequate performance of this study.
- 2.3 For the buildings, and/or systems or ECOs listed in Annex A, all methods of energy conservation which are reasonable and practical shall be considered, including improvements of operational methods and procedures as well as the physical facilities. All energy conservation opportunities which produce energy or dollar savings shall be documented in this report. Any energy conservation opportunity considered infeasible shall also be documented in the report with reasons for elimination.
- 2.4 The study shall consider the use of all energy sources applicable to each building, system, or ECO.
- 2.5 The "Energy Conservation Investment Program (ECIP) Guidance", described in letter from AFPI-ENO, dated 20 JAN 1994 and the latest revision from CEHSC-FU establishes criteria for ECIP

- projects and shall be used for performing the economic analyses of <u>all</u> ECOs and projects. The program, Life Cycle Cost In Design (LCCID), has been developed for performing life cycle cost calculations in accordance with ECIP guidelines and is referenced in the ECIP Guidance. If any program other than LCCID is proposed for life cycle cost analysis (LCCA), it must use the mode of calculation specified in the ECIP Guidance. The output must be in the format of the ECIP LCCA summary sheet, and it must be submitted for approval to the Contracting Officer.
- 2.6 Energy conservation opportunities (ECO) determined to be technically and economically feasible shall be developed into projects acceptable to installation personnel. This may involve combining similar ECOs into larger packages which will qualify for ECIP, MCA, or PCIP funding, and determining in coordination with installation personnel the appropriate packaging and implementation approach for all feasible ECOs.
- 2.6.1 Projects which qualify for ECIP funding shall be identified, separately listed, and prioritized by the Savings to Investment Ratio (SIR).
- 2.6.2 All feasible non-ECIP projects shall be ranked in order of highest to lowest SIR.
- 2.6.3 At some installations Energy Conservation and Management (ECAM) funding will be used instead of ECIP funding. The criteria for each program is the same. The Director of Engineering and Housing will indicate which program is used at this installation. This Scope of Work mentions only ECIP, however, ECAM is also meant.

### 3. PROJECT MANAGEMENT

- 3.1 Project Managers. The A/E shall designate a project manager to serve as a point of contact and liaison for work required under this contract. Upon award of this contract, the individual shall be immediately designated in writing. The A/E's designated project manager shall be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for coordination of work required under this contract. The Contracting Officer will designate a project manager to serve as the Government's point of contact and liaison for all work required under this contract.
- 3.2 <u>Installation Assistance</u>. The Commanding Officer or authorized representative at the installation will designate an individual to assist the A/E in obtaining information and establishing contacts necessary to accomplish the work required under this contract. This individual will be the installation representative.

- 3.3 <u>Public Disclosures</u>. The A/E shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.
  - 3.4 <u>Meetings</u>. Meetings will be scheduled whenever requested by the AE or the Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The A/E's project manager and the Government's representative shall be required to attend and participate in all meetings shall be required to attend and participate in all meetings pertinent to the work required under this contract as directed by the Contracting Officer. These meetings, if necessary, are in addition to the presentation and review conferences.
  - 3.5 <u>Site Visits, Inspections, and Investigations</u>. The A/E shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work.

### 3.6 Records

- 3.6.1 The A/E shall provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the A/E and/or designated representative(s) thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The A/E shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the records.
- 3.6.2 The A/E shall provide a record of requests for and/or receipt of Government-furnished material, data, documents, information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of the work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A/E shall forward to the Contracting Officer within ten calendar days, a reproducible copy of the record of request or receipt of material.
- 3.7 <u>Interviews</u>. The A/E and the Government's representative shall conduct entry and exit interviews with the Department of Public Works (DPW) before starting work at the installation and after completion of the field work. The Government's representative shall schedule the interviews at least one week in advance.
- 3.7.1 Entry. The entry interview shall describe the intended procedures for the survey and shall be conducted prior to commencing work at the facility. As a minimum, the interview

shall cover the following points:

- a. Schedules.
- b. Names of energy analysts who will be conducting the site survey.
  - c. Proposed working hours.
  - d. Support requirements from the Department of Public Works.
- 3.7.2 Exit. The exit interview shall briefly describe the items surveyed and probable areas of energy conservation. The interview shall also solicit input and advice from the DPW.
- 4. <u>SERVICES AND MATERIALS</u>. All services, materials (except those specifically enumerated to be furnished by the Government), plant, labor, supervision and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.
- 5. PROJECT DOCUMENTATION. All ECOs which the A/E has considered shall be included in one of the following categories and presented in the report as such:
- 5.1 ECIP Projects. To qualify as an ECIP project, an ECO, or several ECOs which have been combined, must have a construction cost estimate greater than \$300,000, a Savings to Investment Ratio (SIR) greater than one and a simple payback period of less than ten years. For ECAM projects, the \$300,000 limitation may not apply; in such cases, the AE shall check with the installation for guidance. The overall project and each discrete part of the project shall have an SIR greater than one. All projects meeting the above criteria shall be arranged as specified in paragraph 2.7.1 and shall be provided with programming documentation. Programming documentation shall consist of a DD Form 1391, life cycle cost analysis (LCCA) summary sheet(s) (with necessary backup data to verify the numbers presented), and a Project Development Brochure (PDB). A LCCA summary sheet shall be developed for each ECO and for the. overall project when more than one ECO are combined. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. For projects and ECOs reevaluated from previous studies, the backup data shall consist of copies of the original calculations and analysis, with new pages revising the original calculations and analysis. In addition, the backup data shall include as much of the following as is available: the increment of work under which the project or ECO was developed in the previous study, title(s) of the project(s), the energy to cost (E/C) ratio, the benefit to cost (B/C) ratio, the current working estimate (CWE), and the payback period. The purpose of this information is to provide a

means to prevent duplication of projects in any future reports.

- 5.2 Non-ECIP Projects. Projects which do not meet ECIP criteria with regard to cost estimate or payback period, but which have an SIR greater than one shall be documented. Projects or ECOs in this category shall be arranged as specified in paragraph 2.6.2 and shall be provided with the following documentation: the LCCA summary sheet completely filled out, a description of the work to be accomplished, backup data for the LCCA, ie, energy savings calculations and cost estimate(s), and the simple payback period. The energy savings for projects consisting of multiple ECOs must take into account the synergistic effects of the individual ECOs. In addition these projects shall have the necessary documentation prepared, as required by the Government's representative, for one of the following categories:
- a. Quick Return on Investment Program (QRIP). This program is for projects which have a total cost greater than \$3,000 but less than \$100,000 and a simple payback period of two years or less.
- b. Productivity Enhancing Capital Investment Program (PE-CIP). This program is for projects which have a total cost of greater than \$3,000 but lees than \$100,000 and a simple payback period of four years or less.
- c. OSD Productivity Investment Funding (OSD PIF). This program is for projects which have a total cost of more than \$100,000 and a simple payback period of four years or less.

The above programs and the required documentation forms are all described in detail in AR 5-4, Change No. 1.

- d. Regular Military Construction Army (MCA) Program. This program is for projects which have a total cost greater than \$300,000 and a simple payback period of four to twenty-five years. Documentation shall consist of DD Form 1391 and a PDB.
- e. Low Cost/No Cost Projects. These are projects which the DEH can perform using his resources. Documentation shall be as required by the DEH.
- 5.3 <u>Nonfeasible ECOs</u>. All ECOs which the AE has considered but which are not feasible, shall be documented in the report with reasons and justifications showing why they were rejected.
- 6. <u>DETAILED SCOPE OF WORK</u>. The Detailed Scope of Work is contained in Annex A.
- 7. WORK TO BE ACCOMPLISHED.

- 7.1 Review Previous Studies. Review the previous EEAP study which applies to the specific building, system, or ECO covered by this study. This review should acquaint the AE with the work that has been performed previously. Much of the information the AE may need to develop the ECOs in this study may be contained in the previous study.
- 7.2 <u>Perform Site Surveys</u>. The A/E shall obtain all necessary data to evaluate the ECOs or projects by conducting a site survey. However, the A/E is encouraged to use any data that may have been documented in any previous study. The A/E shall document his site survey on forms developed for the survey, or standard forms, and submit these completed forms as part of the report. All test and/or measurement equipment shall be properly calibrated prior to its use.
- 7.3 . Reevaluate Selected Projects. The A/E shall reevaluate the projects and ECOs listed in Annex A. These are projects and ECOs that the previous study has identified but that have not been accomplished or only parts have been accomplished. If the project or ECO is acceptable as is, that is, there are no changes to the basic project or ECO, the energy savings shown in the previous project may be accepted as accurate but the energy cost and construction cost estimates shall be updated based on the most current data available. With the above information the project shall then be analyzed based on current ECIP criteria. If the project or ECO is basically acceptable but some of the buildings in the original project have been deleted or new buildings can be added, the necessary changes shall be made to the energy savings, the energy costs and construction costs shall be updated, and the revised project or ECO shall then be analyzed using current ECIP guidance. If the original project or ECO has had numerous changes made to it so that all of the numbers are suspected of being inaccurate, but the project or ECO is still considered feasible, the AE shall develop the project from the beginning and analyze it with the current ECIP guidance. These projects shall be separately listed in the report.
- 7.4 Evaluate Selected ECOs. The A/E shall analyze the ECOs listed in Annex A. These ECOs shall be analyzed in detail to determine their feasibility. SIRs shall be determined using current ECIP guidance. The A/E shall provide all data and calculations needed to support the recommended ECO. All assumptions and engineering equations shall be clearly stated. Calculations shall be prepared showing how all numbers in the ECO were figured. Calculations shall be an orderly step-by-step progression from the first assumption to the final number. Descriptions of the products, manufacturers catalog cuts, pertinent drawings and sketches shall also be included. A LCCA summary sheet shall be prepared for each ECO and included as part of the supporting data.

- 7.5 Combine ECOs Into Recommended Projects. During the Interim Review Conference, as outlined in paragraph 7.6.1, the A/E will be advised of the DPW's preferred packaging of recommended ECOs into projects for implementation. Some projects may be a combination of several ECOs, and others may contain only one. These projects will be evaluated and arranged as outlined in paragraphs 5.1, 5.2, and 5.3. Energy savings calculations shall take into account the synergistic effects of multiple ECOs within a project and the effects of one project upon another. The results of this effort will be reported in the Final Submittal per paragraph 7.6.2.
- 7.6 Submittals, Presentations and Reviews. The work accomplished shall be fully documented by a comprehensive report. report shall have a table of contents and shall be indexed. Tabs and dividers shall clearly and distinctly divide sections, subsections, and appendices. All pages shall be numbered. Names of the persons primarily responsible for the project shall be The A/E shall give a formal presentation of the included. interim submittal to installation, command, and other Government personnel. Slides or view graphs showing the results of the study to date shall be used during the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. A review conference will be conducted the same day, following the presentation. Each comment presented at the review conference will be discussed and resolved or action items assigned. It is anticipated that the presentation and review conference will require approximately one working day. The presentation and review conference will be at the installation on the date agreeable to the DPW, the A/E and the Government's representative. The Contracting Officer may require a resubmittal of any document(s), if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended purpose.
- 7.6.1 Interim Submittal. An interim report shall be submitted for review after the field survey has been completed and an analysis has been performed on all of the ECOs. The report shall indicate the work which has been accomplished to date, illustrate the methods and justifications of the approaches taken and contain a plan of the work remaining to complete the study. Calculations showing energy and dollar savings, SIR, and simple payback period of all the ECOs shall be included. The results of the ECO analyses shall be summarized by lists as follows:
- a. All ECOs eliminated from consideration shall be grouped into one listing with reasons for their elimination as discussed in par 5.3.
- b. All ECOs which were analyzed shall be grouped into two listings, recommended and non-recommended, each arranged in

dessending order SIR. These lists may be subdivided by building or area as appropriate for the study.

The A/E shall submit the Scope of Work and any modifications to the Scope of Work as an appendix to the report. A narrative summary describing the work and results to date shall be a part of this submittal. At the Interim Submittal and Review Conference, the Government's and A/E's representatives shall coordinate with the DPW to provide the A/E with direction for packaging or combining ECOs for programming purposes and also indicate the fiscal year for which the programming or implementation documentation shall be prepared. The survey forms completed during this audit shall be submitted with this report. The survey forms only may be submitted in final form with this submittal. They should be clearly marked at the time of submission that they are to be retained. They shall be bound in a standard three-ring binder which will allow repeated disassembly and reassembly of the material contained within.

- 7.6.2 Final Submittal. The A/E shall prepare and submit the final report when all sections of the report are 100% complete and all comments from the interim submittal have been resolved. The A/E shall submit the Scope of Work for the study and any modifications to the Scope of Work as an appendix to the submittal. The report shall contain a narrative summary of conclusions and recommendations, together with all raw and supporting data, methods used, and sources of information. report shall integrate all aspects of the study. The recommended projects, as determined in accordance with paragraph 5, shall be presented in order of priority by SIR. The lists of ECOs specified in paragraph 7.6.1 shall also be included for continuity. The final report and all appendices shall be bound in standard three-ring binders which will allow repeated disassembly The final report shall be arranged to include: and reassembly.
- a. An Executive Summary to give a brief overview of what was accomplished and the results of this study using graphs, tables and charts as much as possible (see Annex B for minimum requirements).
- b. The narrative report describing the problem to be studied, the approach to be used, and the results of this study.
- c. Documentation for the recommended projects (includes LCCA Summary Sheets).
  - d. Appendices to include as a minimum:
    - 1) Energy cost development and backup data
    - Detailed calculations
    - Cost estimates

- 4) Computer printouts (where applicable)
- 5) Scope of Work

### LOUISVILLE DISTRICT CORPS OF ENGINEERS ENGINEERING DIVISION, A/E MANAGEMENT SECTION (CEORL-ED-M-S)

### ANNEX A, b. DETAILED SCOPE OF WORK FORT KNOX, KY July 1, 1994

- 1. PROJECT NAME & LOCATION: This is a FY94S Fort Knox EEAP b. Limited Energy Study (Glass). The study will investigate the feasibility of reducing glass area in high bay buildings by identifying and evaluate strategies for glass reduction, insulate, and infrared heat for the operation of those structures. The study includes a survey in the various permanent buildings and structural systems which are summarized below as three separate ECOs, as listed below and are located in Figure A-1.1, and listed in Figure A-1.2:
  - Glass reduction in high bay buildings.
  - Insulation of superstructure including glass (blown on) in high bay buildings.
  - Infrared heat in high bay buildings.
- Other ECOs that are additional for high bay buildings to reduce energy consumed from that type structure are to be considered as identified by the A/E while conducting the field investigations.
- 2. GENERAL SOW vs. DETAILED SOW: The General Scope of Work (GSOW) will apply to contract efforts as modified by the Detailed SOW. Should conflicts occur between the GSOW and the Detailed SOW, the Detailed SOW shall govern.
- 3. RESPECTIVE POC's for this study:
  Louisville District COE-Charles(Chuck) Lockman/CEORL-ED-M-S
  (502) 582-6041, fax# 6763, or 5281

Fort Knox, KY DPW- Gary Meridith/DPW, Energy Officer, or Kevin Addison

(502) 624-6828, fax#3679

Architect//Engineer(A/E) - Ned W. (Chuck) Belt/ or Keith Derrington

DACA01-94-D-0034 Systems Corp., Suite 306, Cherokee Pl

2200 Sutherland Avenue

Knoxville, TN 37919

(615) 521-6536, or FAX# 524-7514

4.1 The A/E shall provide all work necessary to complete the Limited Energy Study (Glass) as defined by the GSOW including the annexes. Information and instructions contained within the SOW are provided as a means for the A/E Project Manager to expand or modify the GSOW as may be needed to suit the study for the ECOs project areas listed in par. 1. above. This study is much more flexible than the standard EEAP ESOS type study, and is meant to address specific opportunities, buildings and/or systems that the installation feels

have high and low potential for energy or dollar savings.

- 4.2 The study will analyze all Limited Energy Study (Glass) ECOs as listed in par. 1. above and as listed in Figure A-1.2.
- 4.3 The study will consider new designs, for energy saver trenders in equipmnet that make these facilities more cost effective, heat savings, and energy saving.
- 4.4 If metering of a facility is required, the A/E shall assist the DPW in arranging for the installation of electrical, however, existing data is available at the installation, and by other studies/ surveys.
- 5. <u>DETAILED REQUIREMENTS:</u> All detail requirements selected at Fort Knox for the purpose of this study, shall specifically include the specific facilities listed in par, 1. above and projects identified by the DPW staff.

In general, the facilities and projects, when investigated relative to the ECO's provided as follows:

The contractor will review existing building drawings, existing conditions maps, survey and monitor existing conditions, and analyze the listed ECO's, and analyze additional ECO's readily discoverable during the field survey.

- 6. PERFORMANCE: The total time required for completion of the study and the performance of all work shall not be more than 180 calendar days from the Notice to Proceed (NTP) on the contract. If the study takes the A/E less time than scheduled to achieve, a shortened schedule for submittal and coordination of review and interim review meeting at the installation may be coordinated by the A/E with all parties involved in the review process. Figure A-6.1. Schedule of pertinent events and milestone dates for acceptable performance of the study at Fort Knox. Changes or adjustments made to the SOW during the term of the project study shall be make by the COE.
- 7. <u>SUBMITTAL:</u> The A/E's Project Manager shall provide direct distribution of all required submittal and documents in the numbers as listed in Figure A-7.1.
- 8. GOVERNMENT-FURNISHED INFORMATION: The following list of reference documents will be furnished to the A/E:
- a. Energy Conservation Investment Program (ECIP) Guidance, dated 20 Jan 1994,
  - b. TM 5-785, Engineering Weather Data.
- c. AR 5-4, Change No. 1, Department of the Army Productivity Improvement Program.
- d. AR 415-15, 1 Jan 84, Military Construction, Army (MCA) Program Development.
  - e. The latest MCP Index.

- f. Drawings at the DPW of each facility, if available.
- 9. LCCID FROM BLAST: A computer program titled Life Cycle Costing in Design (LCCID) will be used and is available from the BLAST Support Office in Urbana, Illinois for a nominal fee. This computer program will be used for performing the economic calculations for ECIP and non-ECIP ECOs. The A/E is encouraged to obtain and use this computer program. The BLAST Support Office can be contacted at 144 Mechanical Engineering Building, 1206 West Green Street, Urbana, Illinois 61801. The telephone number is (217) 333-3977, or (800) 842-5478.
- 10. If it is possible that the buildings in this study will be subject to the computer modeling requirements of paragraph 2.6 of the GSOW, then the simulation programs acceptable to the office doing the technical review should be listed in the detailed scope of work. Some acceptable simulation programs follow:
  - a. Building Loads and System Thermodynamics (BLAST) \*
  - b. DOE 2.1B \*
  - c. Carrier E20 or Hourly Analysis Program (HAP) \*\*
- d. Trane Air-Conditioning Economics (TRACE) \*\*
  \* Very accurate, but requires a lot of time for input; therefore it is rather expensive for straightforward projects.
  \*\* Adequate for load determination, equipment selection, and energy performance for most projects.

### FIGURE A-1.2 BUILDING AND/OR SYSTEMS LIST:

### ENERGY ENGINEERING ANALYSIS PROGRAM (EEAP) FY94: FY94S EEAP FORT KNOX b. LIMITED ENERGY STUDY (GLASS)

### BUILDINGS/SYSTEMS LIST

		***
	Area/Insulate/Infared	neat:
Bldg. No.	Bldg. No.	
17	5213	
18	5220	
86	5222	
94	5253	
98	5927	
101	5943	
158	6113	
1530	6114	
2647	6115	
2754	6116 .	
2755	6117	
2756	6118	
2757	6142	
2763	6143	
2764	6144	
2765	6145	
2766	6146	
2767	6147	
2770	6560	
2778	6561	
2780	6562	
2942	6563	
2943	6564	
2944	6576	
2955	6577	
2959	6591	
2960	6592	
2961	482	
483	484	
485	486	
487 .	<b>85</b> 2	

FIGURE A-6.1. SCHEDULE for a. Water Conservation Study, and b. Limited Energy Study (Glass) FY94S EEAP, Fort Knox, KY are as follows if awarded together:

	Calendar	-	<u>Actua</u>	lDa	<u>te</u>
	<u>cem</u>		Jun 1	L4,	94
	COE SOW meeting w/Energy OfficerTBD COE finishes DSOW for FK reviewTBD		Jul 0	01,	94
		,	Jul 1		
	COE visits FK to collect Scope changes/adds  COE Revises SOWTBD	·	Jul 2	21,	94
1.	RFP LETTER TO A/ETBD	• •	Jul 2	25,	94
2.	RFP LETTER RECEIVED BY A/ETBD (COE, DPW, and A/E coordinates date)	••	Jul 2	25,	94
	a. A/E Submits Proposal FAX'd/Neg'ns beginTBD	• •	Jul :	28,	94
3.8	b. SOW formal mtg. @ FK, or Tel. conf.callTBD	• •	Jul :		
4.	Award of Contract-Start Up/NTP (SAF)1	• •	Aug	01,	94
	ENTRY INTERVIEW @ Fort Knox, KY1	• •	Aug	01,	94
	INTERIM SUBMITTAL @ 60%	• •	Nov	01,	94
7.	REVIEW PERIOD OF THE INTERIM SUBMITTAL120 (COE gathers comments from IN-HOUSE/DPW/MACOM)	••	Nov	20,	94
	INTERIM REVIEW MEETING @ FK		Nov	30,	94
8.	(COE, DPW, A/E, & others)	.•			
9.	EXIT INTERVIEW MTG. @ FK	• •	Nov	30,	94
	(A/E sends directly to as listed, herein)	••	Dec		
11	. DPW may require to have input on the DD 180	• •	Jan	01,	94
	Form 1391 from A/E 2. DPW SUBMITS DD Form 1391'sTBD		•		

FIGURE A-7.1. Distribution of Submittals: The A/E shall make direct submittal and responses to comments as indicated by the following schedule:

Organization	Correspondence Executive Su Reports Fiel	
COMMANDER, US Army Engineer District, Louisv ATTN: CEORL-ED-M-S/Charles Lockman P.O. Box 59 (express-600 Dr. Martin King Pl Louisville, KY 40201-0059 tel. (502) 582-6041, or fax# 6763, or 528	ace)	1*
COMMANDER, US Army Armor Center & Fort Knox ATTN: ATZK-EH-PS/Gary Meredith, Energy Off Building 77 Fort Knox, KY 40121-5000 tel. (502) 624-8358 or fax# 3679	c 1 1 1 Ficer	1*
HQ TRADOC (MACOM) ATTN: ATBO-GFE/Al Betcher Fort Monroe, VA 23651-5000 tel. (804) 727-2453, or fax# 2362	1 1 1	1*
COMMANDER, US Army Engineer District, Mobil ATTN: CESAM-EN-CC/Tony Battaglia (EEAP TCX P.O. Box 2288 Mobile, AL 36628-0001 tel. 205-690-2618, or fax# 2424	le 0 1**9'	ġ'
COMMANDER, US Army Engineer Div.,Ohio Rive ATTN: CEORD-DL-M/Joe Semrad P.O. Box 1159 Cincinnati, OH 45201-1159 tel. 513-684-3975	er 0 1**0	0
COMMANDER, US Army Corps of Engineers ATTN: CEMP-ET/Dan Gentil (EEAP Mgr.) 20 Massachusetts Avenue Washington, D.C. 20314-1000 tel. 202-272-8622	0 1**0	0
COMMANDER, US Army Logistics Evaluation Ad ATTN: LOEA-PL/Mr. Keath New Cumberland Army Depot New Cumberland, Pa. 17070-5006	gency 0 1**0	0
* Field Notes submitted in final at Inter	im submittal. ummary Only	

\*\* Submit copies of the final Executive Summary Only

### ANNEX B

### EXECUTIVE SUMMARY GUIDELINE

- 1. Introduction.
- Building Data (types, number of similar buildings, sizes, etc.)
- 3. Present Energy Consumption of Buildings or Systems Studied.
  - o Total Annual Energy Used.
  - o Source Energy Consumption.
    Electricity KWH, Dollars, BTU
    Fuel Oil GALS, Dollars, BTU
    Natural Gas THERMS, Dollars, BTU
    Propane GALS, Dollars, BTU
    Other QTY, Dollars, BTU
- 4. Reevaluated Projects Results.
- 5. Energy Conservation Analysis.
  - o ECOs Investigated.
  - o ECOs Recommended.
  - o ECOs Rejected. (Provide economics or reasons)
  - o ECIP Projects Developed. (Provide list)\*
  - o Non-ECIP Projects Developed. (Provide list)\*
  - o Operational or Policy Change Recommendations.
- \* Include the following data from the life cycle cost analysis summary sheet: the cost (construction plus SIOH), the annual energy savings (type and amount), the annual dollar savings, the SIR, the simple payback period and the analysis date.
- Energy and Cost Savings.
  - o Total Potential Energy and Cost Savings.
  - o Percentage of Energy Conserved.
  - o Energy Use and Cost Before and After the Energy Conservation Opportunities are Implemented.

### ANNEX C

### REQUIRED DD FORM 1391 DATA

To facilitate ECIP project approval, the following supplemental data shall be provided:

- a. In title block clearly identify projects as "ECIP."
- b. Complete description of each item of work to be accomplished including quantity, square footage, etc.
- c. A comprehensive list of buildings, zones, or areas including building numbers, square foot floor area, designated temporary or permanent, and usage (administration, patient treatment, etc.).
- d. List references, and assumptions, and provide calculations to support dollar and energy savings, and indicate any added costs.
- (1) If a specific building, zone, or area is used for sample calculations, identify building, zone or area, category, orientation, square footage, floor area, window and wall area for each exposure.
  - (2) Identify weather data source.
- (3) Identify infiltration assumptions before and after improvements.
- (4) Include source of expertise and demonstrate savings claimed. Identify any special or critical environmental conditions such as pressure relationships, exhaust or outside air quantities, temperatures, humidity, etc.
- e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of the complete existing installation is required to make accurate determinations of required retrofit actions.
- f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting shall be only of the level to meet current criteria. Lamp changes in existing fixtures is not considered an ECIP type project.
- g. An ECIP life cycle cost analysis summary sheet as shown in the ECIP Guidance shall be provided for the complete project and for each discrete part included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculations showing how savings were

determined shall be included.

- h. The DD Form 1391 face sheet shall include, for the complete project, the annual dollar and MBTU savings, SIR, simple amortization period and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.
- i. The calendar year in which the cost was calculated shall be clearly shown on the DD Form 1391.
- j. For each temporary building included in a project, separate documentation is required showing (1) a minimum 10-year continuing need, based on the installation's annual real property utilization survey, for active building retention after retrofit, (2) the specific retrofit action applicable and (3) an economic analysis supporting the specific retrofit.
- k. Nonappropriated funded facilities will not be included in an ECIP project without an accompanying statement certifying that utility costs are not reimbursable.
- 1. Any requirements required by ECIP guidance dated 4 Nov 1992 and any revisions thereto. Note that unescalated costs/savings are to be used in the economic analyses.
- m. The five digit category number for all ECIP projects except for Family Housing is 80000. The category code number for Family Housing projects is 71100.

### GLOSSARY OF ACRONYMS

Architect Engineer A/E Army Regulation AR Benefit to Cost B/C Corps of Engineers COE Current Working Estimate CWE Director of Public Works DPW Department of Defense DOD Detailed Scope of Work DSOW E/C Energy to Cost Energy Conservation and Management ECAM Energy Conservation Investment Program ECIP Energy Conservation Opportunity ECO Energy Engineering Analysis Program EEAP Engineering and Housing Support EHSC Energy Monitoring Analysis Program **EMCS** Energy Savings Opportunity Survey **ESOS** General Scope of Work **GSOW** Headquarters US Army Corps of Engineers HQUSACE Life Cycle Cost Analysis LCCA LCCID Life Cycle Cost In Design Major Army Command MACOM Military Construction Army MCA National Energy Conservation Policy Act NECPA OSD Productivity Capital Investment Funding OSD PIF PCIP Productivity Capital Investment Program Project Document Brochure PDB Productivity Enhancing Capital Investment Program PECIP Point of Contact POC Quick Return on Investment Program ORIP SIR Savings Investment Ratios

Technical Center of Expertise

TCX

### SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION

October 12, 1994

Commander, US Army Engineer District, Louisville ATTN: CEORL-ED-M/Charles Lockman P. O. Box 59
Louisville, KY 40201-0059

Dear Mr. Lockman:

RE: FY94 Fort Knox EEAP Limited Energy Study (Glass) Interim Review Meeting Contract No. DACA01-94-0034

The Fort Knox Glass Study Interim Review Meeting was held on 11 October 1994 at Fort Knox. The following are additional comments and decisions reached during the meeting:

### Tuesday, 11 October 1994

Persons Present:

Kevin Addison Ft. Knox DPW Energy Officer
Gary Meredith Ft. Knox DPW Energy Officer
Charles Lockman Louisville COE Representative
Julie Hollensbe Systems Corp Program Manager

- To help reduce the investment cost for Building 2647, the premium finish and 95% of the heavy duty reinforcement will be removed from the cost estimate.
- The projects will be grouped for both ECIP and FEMP projects. There will be two (2) ECIP projects developed. The Airfield hangars will not be included in the ECIP projects. The FEMP projects will be grouped so the projects are less than \$1,000,000 invested. There will be five (5) or six (6) FEMP projects depending on the investment costs.
- The Final Report projects will include the environmental savings to not replace the fuel tanks in 1998. These savings are from a report supplied to Systems Corp from the Fort Knox Environmental Group. The cost estimates included in the Final Report will not include any costs to remove the fuel tanks. All removal and testing of the fuel tanks will be performed in 1998 as scheduled by the Fort Knox Environmental Group.
- The Final Report will include an updated summary table. This table will be similar to Table 7.4.1 in the Interim Report.

Charles Lockman Page 2 October 12, 1994

 Kevin Addison supplied Systems Corp with a sample ECIP packet the installation developed for an ECIP project. Systems Corp will follow this sample for this report.

If you have any questions or comments regarding this material, please do not hesitate to contact me at (708) 462-9150.

Sincerely,

SYSTEMS CORP

Julie Hollensbe, E.I.T.

	•			
Project Review	Interim	O Project: EEAP-Limited Energy Study	Reviewer: Fort Knox DPW	Pg 1 of 1
Comments	Pre-Final	O Location: Fort Knox, KY	Name: Kevin Addison	09/27/94
	Final	O Year: P.N.	Organization: DPW, EP & S	

No.	Vol Section Page	1				
-		Page	COMMENTS	Code	(include location of documents)	Ref
	က	2	onld be:	A	This will be incorporated into the	
			Gas - \$4.7662/MCF		Final Report:	
	-		Fuel Oil - \$0.9214/Gal		Natural Gas - \$4.62/Mbtu	
			This will change all the life cycle cost		Fuel Oil - \$6.60/Mbtu	
			analyses.			
2	7	9	In the Final Report, put totals at bottom	4	The summary table for all ECOs	
			for all projects in list.		will be included in the Final Report.	نب
3	တ		Air Field - impact on central plant? Do	⋖	There are several other hangars	
			all buildings at the airfield need to be		not included in this study still	
			studied. Can we do away with central		using the central plant.	
			plant at the airfield?			
-	ı	ı	Computer disk with life cycle cost analyses	A	This will be included with the	
			summaries, cost estimates and heating		Final Report.	
			calculations.			
	ı	ı	Infra-red heat - will the occupants in all of	٧	The occupants will be no less	
		•	these buildings be comfortable if	•	comfortable working under/inside	
			working inside/under vehicles? Fort		the vehicle than with the forced air	
			Campbell had bad example where		heating system as long as the	
			infra-red heat was installed and people		infra-red heating system is sized	·
			don't like it.		properly. All cost estimates were	
					developed in cooperation with	
					infra-red heating vendors, which	
					ensures the proper sizing of the	
	C				systems.	
٥	٥	6-4	Revarity the cost estimate for Bldg 2647?	<	The premium final and heavy	
I he price	0		i ne prices seem high.		reinforcement (5%) will be removed for the Final Report.	

Project Review Inter	erim O P	Project: EEAP-Limited Energy Study	Reviewer: Louisville COE	Pg 1 of 1
Comments Pre-	e-Final O L	Location: Fort Knox, KY	Name: Charles Lockman	10/04/94
Fina	ral O Y	Year: P.N.	Organization: CEORL-ED-MS	

Comment					Action	RESOLUTIONS	
No.	No.	Vol. Section Page	Page		Code	(include location of documents)	Ref.
-	<del></del>	T of C	≔	Figure 3.4.1.1 page 3.6 - was this listed out	Α	This is in the proper order. The	
				of order on purpose or will it be included		Table of Contents lists the text	
				in the Flnal Report as 3.6 in order? Was		sections, the tables then the	
				it added later in the Interim Report?		figures in order.	
7	•	1	ı	MJ/YR - Meaning of this would not be	4	MJ/YR = megajoules/year. New	
				clear to the non-electrical person trying		specifications requires EEAPs	
				to understand the study. Provide an		to be in metric units. This will be	
				explanation in report.		explained in the Final Report.	
ო	<del></del>	7	2-1	Does the number of buildings surveyed	4	Systems Corp considered 486B	
				add up correctly? 1. says 72. Adding		and 486HB as one buildings.	1-1-
				up 2.1.1 and 2.1.2 seems to be 73		Bldg 486HB is a high bay add-on	
				buildings surveyed.		to 486B. Counting this as one	
						building brings the total number	
٠				The state of the s		of buildings surveyed to 72.	
4	<del>-</del>		7-1	7.1 last sentence - refernces Section 10 for	A	The sentence should reference	
				a list of substitute buildings. There is no		Section 9. This section includes	
				Section 10		correspondence summarizing	
						the Field Survey.	
သ	ı	,	1	Will Systems's Corp provide catalog cuts	A	The catalog cut sheets will be	
				of examples for Infra-red high and low		included in the program	
				temperature units and etc. systems		documents in the final report.	
				designed/study is based on?			
9	<del>-</del>	က	3-1	If other ECOs were considered by	4	No other ECOs are known in the	
٠				Systems Corp as scoped, 4 think the report		facilities included in the scope	
				should say no other ECOs are known		of work. Many of these facilties	
				or if there are new ones then point them		were included in the last study	
				out in 3.1		evaluating lighting improvements.	
ACTION CODES: A - Accepted/Concur	ODE	S: A-A	ccepte	D - Action Deferred	N - Non-concur	oncur W - withdraw	
			,				

•		•		
Project Review	Interim	O Project: EEAP-Limited Energy Study	Reviewer: Louisville COE Pg	Pg 1 of 1
Comments	Pre-Final	D Location: Fort Knox, KY	Name: John Trinkle 10/0	10/02/94
	Final	O Year: P.N.	Organization: CEORL-ED-MA	

Common					Action	DECOLITIONS	
	>	Vol Section Dage	Dage	OTNEMTO			900
NO.	<u>-</u>	Section	rage	H٢	apon		Ker.
_	•		ı	Check with Gary Meredith since John	⋖	Fort Knox wanted varification	
				Trinkle has furnished JOC drawings for		of the projected savings for the	
				infra-red heat in the hangars.		hangars.	
7	1	1	ı	Without demolition and removal of the	A	Both projects will not be	
				existing radiant heat in the hangars,		implemented.	
				infra-red probably is not a cost savings.			
က	ı	1	t	Use caution in re-heating maintenance	A	The cost estimates include the	
				shops at St. John's since many buildings		price to add natural gas service	
				do not have gas service.		in areas where gas service is	
						not currently available.	
4	١	1	1	Trinkle has been upgrading heaters,	A	Systems Corp evaluated window	
				blocking in windows and sealing doors		upgrades in gymnasiums and	,
				and windows at various tank maintenance		a print shop. This was not	
				buildings. Make sure none are repeated.		evaluated in any tank	
						maintenance shops.	
2	1	1	ı	Make sure any magnetic seal will be	A	The produst cut sheets included	
				durable and useable under the weather		in the Final Report will reflect	
				conditions at Fort Knox.		products that can be used in the	
						Fort Knox climate.	
ဖ	ı	ı	ı	Text after page 2-5 is missing.	∢	The text following page 2-5 should	
						continue on page 2-14. On pages	
						2-6 through 2-13 are tables.	
			•		•		
ACTION CODES: A - Accepted/Concur	ODE	S: A - A	ccepte	D - Action Deferred	N - Non-concur	oncur W - withdraw	A.c

Project Review	Interim	O Project: EEAP-Limited Energy Study	Reviewer: Mobile COE	Pg 1 of 1
Comments	Pre-Final	O Location: Fort Knox, KY	Name: WesTurner	10/06/94
	Final	O Year: P.N.	Organization: CESAM-EN-DM	

																							-						
	Ref.																												
RESOLUTIONS	(include location of documents)	This will be corrected in the Final	Report. The main estimate will	reference a detailed estimate for	the infra-red heaters. This will	allow you to clearly see the	contents of the infra-red systems.	This is correct. The vendors who	supplied Systems Corp with	quotes have systems applicable	for offices. This will be included in	the cut sheets enclosed in the	Final Report. Also, please note	the offices in the shops are not	a typical office: ceilings are a	minimal of 10'.	These will be removed in the	Final Report's cost estimates.		MBH is conventional useage to	mean thousand BTU per hour.	MBTU/HR means million BTU	per hour. The Industry standard	is currently moving towards using	MBTU/HR as Systems Corp has	used it in this report.	These cut sheets will be included	in the Final Report.	oncur W - withdraw
Action	Code	4						4				-					۷			z		***					∢		N - Non-concur
	COMMENTS	All ECO-1 estimates show a lump sum	figure for Infra-red units. This figure needs	to be broken out to detail items such as unit	type, unit size, unit quantity, electrical	service requirements, piping requirements	and etc.	From cost estimate data, it appears all	steam/hot water unit heaters will be	removed from offices, latrines and other	low ceiling areas and replaced with infra-	red heaters. Provide data to support this	application of infra-red heaters.				Cost estimates contain line items with no	quantities indicated - complete quantities	or remove line items.	The unit "MBTU/HR" used in this study is	confusing, it should be replaced with a	more conventional unit such as "MBH"			•		Furnish catalog cuts of proposed infra-red	heaters and acrylic window systems which include items such as system performance.	A - Accepted/Concur D - Action Deferred N -
	Page	1						1									,			1						**	١		Accept
	Vol. Section Page	2						5									2			1		-					1		
	Vol.	-						-									1			1					•				CODE
Comment	No.					=:		2					-				က			4					•		2		ACTION CODES:

Energy Engineering Analysis Program (EEAP)

Limited Energy Study (Glass)

Fort Knox, Kentucky

### Interim Review



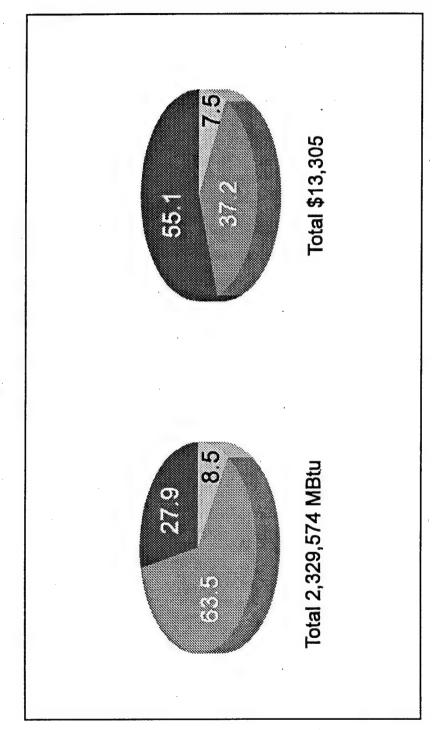


SYSTEMS ENGINEERING AND MANAGEMENT CORPORATION

Glide Path Actual Fort Knox Energy Consumption MBfu/KSF/Yr

### Fort Knox Energy Consumption

FY93



C-3

io I

■ Natural Gas

■ Electric

Energy Charges

Natural Gas

Fuel Oil

\$3.34/MBtu \$5.05/MBtu

C-4

Work Accomplished to Date

Field Survey for 72 Buildings

Evaluation of 72 Energy Conservation Opportunities

Preparation and Completion of all Field Notes

Completion of Interim Report

Energy Conservation Opportunities Evaluated

- ECO-1: Infra-Red Heat
- ECO-2: Window/Wall Insulation

ECO-1

Equipment Evaluated

 Natural Gas Infra-Red Unit Heaters w/Electric Ignition

ECO-1

Buildings Evaluated

Warehouse/Storage

Aircraft Hangar

Maintenance Shops

Vehicle and Tank Maintenance Shops

### ECO-1

Maintenance and Replacement Costs

- Boiler Preventive Maintenance Annually
- Boiler Repair every 7 Yrs (Year 7 and 14)
- Unit Heater Repair every 10 Yrs (Year 5 and 10)
- Steam Trap Replacement every 10 Yrs (Year 5 and 10)

### Maintenance and Replacement Costs for ECO-1

Description of Work	<i>Material</i> Costs	Labor Costs	Labor Costs
Preventive Maintenance on Hot Water Boiler, Over 1 MBtu/h Performed Annually	06\$	\$700	\$790
Preventive Maintenance on Steam Boiler, Over 1 MBtu/h Performed Annually	\$170	\$820	066\$
Preventive Maintenance on Unit Heaters Performed Annually	\$120	\$275	\$395
Repair of Natural Gas Boiler, Between 1 MBtu/h and 10 MBtu/h, Performed every 7 Yrs	\$2,295.50	\$915.85	\$3.211.35
Repair of Oil Boiler, Between 1 MBtu/h and 10 MBtu/h, Performed every 7 Yrs	\$477.70	\$431.40	\$909.10
Repair of Unit Heaters, Performed every 10 Yrs	\$150	\$124.15	\$274.15
Replace Steam Traps, 1" Threaded Performed every 10 Yrs	\$120	\$49.40	\$169.40

ECO - 1: Infra-Red Heat	AIRR	6.41%
	SIR	1.88
	Simple Payback	9.64
	First Year Savings	\$385,411
	Total Investment	\$3,717,049

#### ECO -1: Final Project Grouping

Total Investment	\$807,929	\$969,629	. \$857,148	\$132,303	. \$950,046
Bldg Number	86, 92, 94, 98, 100, 101, 482-486	2754-2757, 2786-2789, 2955, 2958 2959-2964, 2973, 2974, 2979, 2980, 2969-2972	·2762-2767; 2770, 2778, 2781 2942-2944	5220, 5253	6113-6118, 6142-6147, 6560-6564, 6576, 6577, 6592
Area	DPW, Armor Motor Pool	St John's Tank Motor Park	Hurley Tank Motor Park, Boatwright 194th Armored Equipment Shop	Airfield Hangars	Richardson, Potts and Farmer Motor Tank Park

ECO-2

Material Evaluated

Plexiglass Sheets

Dryvit Exterior Insulation

ECO-2

Buildings Evaluated

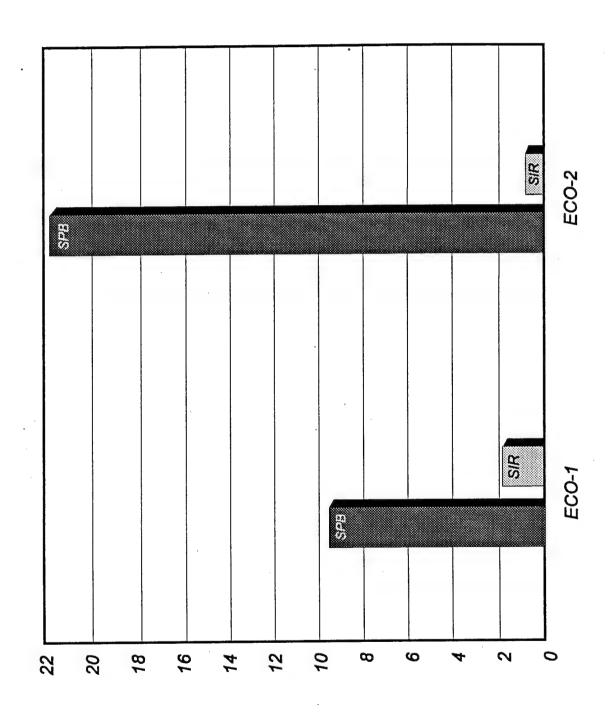
Gymnasiums

Print Shop

ECO - 2: Window/Wall Insulation

Area	Total Investment	First Year Savings	Simple Payback	SIR	AIRR
Gymnasiums	\$17,586	\$2,682	6.56	3.20	9.27%
Print Shop	\$181,590	\$6,404	28.35	.74	1.55%
Total	\$199,177	\$9,081	21.93	96.	2.87%

Fort Knox Limited Energy Study (Glass)



#### Project Results

AIRR	6.41%	2.87%	5.90%
SIR	1.88	96.	1.84
Simple Payback	9.64	21.93	9.93
First Year Savings	\$385,411	\$9,081	\$394,492
Total Investment	\$3,717,049	\$199,177	\$3,916,226
ECO	ECO-1	ECO-2	Total

#### Remaining Phases

Response to Interim Review Comments

Incorporation of Environmental Impact

Preparation of Programming and Implementation Documents

Final Report - October 28, 1994

LIFE CYCLE COST ANALYSIS SUMMARY STUDY: 2647ECO2 ENERGY CONSERVATION INVESTMENT PROGRAM (ECIP) LCCID 1.080 INSTALLATION & LOCATION: FORT KNOX REGION NOS. 4 CENSUS: 3
PROJECT NO. & TITLE: 2647ECO2 ECO-2 WINDOW/WALL INSULATION FISCAL YEAR 95 DISCRETE PORTION NAME: INFRARED ANALYSIS DATE: 10-18-94 ECONOMIC LIFE 20 YEARS PREPARED BY: JAH 1. INVESTMENT A. CONSTRUCTION COST \$ 97274.

B. SIOH \$ 4864.

C. DESIGN COST \$ 4864.

D. TOTAL COST (1A+1B+1C) \$ 107001. E. SALVAGE VALUE OF EXISTING EQUIPMENT \$
F. PUBLIC UTILITY COMPANY REBATE \$ G. TOTAL INVESTMENT (1D - 1E - 1F) 107001. 2. ENERGY SAVINGS (+) / COST (-)
DATE OF NISTIR 85-3273-X USED FOR DISCOUNT FACTORS OCT 1993 UNIT COST SAVINGS ANNUAL \$ DISCOUNT DISCOUNTED UEL \$/MBTU(1) MBTU/YR(2) SAVINGS(3) FACTOR(4) SAVINGS(5) 

 0.
 \$
 0.
 15.61

 0.
 \$
 0.
 17.56

 0.
 \$
 0.
 19.97

 1917.
 \$
 8859.
 20.96

 0.
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 0.
 17.58

 0.
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 \$
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 14.74

 1917.
 \$
 8859.

 A. ELECT \$ .00 B. DIST \$ 6.60 0. C. RESID \$ .00 0. D. NAT G \$ 4.62 185675. E. COAL \$ .00 F. LPG \$ .00 0. 0. 0. M. DEMAND SAVINGS N. TOTAL 3. NON ENERGY SAVINGS(+) / COST(-) (1) DISCOUNT FACTOR (TABLE A)
(2) DISCOUNTED SAVING/COST (3A X 3A1) A. ANNUAL RECURRING (+/-) 0. 0. B. NON RECURRING SAVINGS (+) / COSTS (-) SAVINGS(+) YR DISCNT DISCOUNTED COST(-) OC FACTR SAVINGS(+)/ COST(-) ITEM (3) COST(-)(4) (1) (2) 0. d. TOTAL 0. C. TOTAL NON ENERGY DISCOUNTED SAVINGS(+)/COST(-)(3A2+3Bd4)\$ 0. 4. FIRST YEAR DOLLAR SAVINGS 2N3+3A+(3Bd1/(YRS ECONOMIC LIFE))\$ 8859. 5. SIMPLE PAYBACK PERIOD (1G/4) 12.08 YEARS \$ 185675. 6. TOTAL NET DISCOUNTED SAVINGS (2N5+3C) (SIR) = (6 / 1G) =1.74 7. SAVINGS TO INVESTMENT RATIO (IF < 1 PROJECT DOES NOT QUALIFY) 5.98 % 8. ADJUSTED INTERNAL RATE OF RETURN (AIRR):

\_\_\_\_\_\_ Estimate: BLDG 2647 Date: 12-Oct-94 WINDOW/ WALL INSULATION ECO-2 Description: LIMITED EEAP (GLASSBid Date: Project: Location: FORT KNOX, KY Job #: 94013.02 \*\*\*\*\* City indx:Louisville, KY Sq. footage: Description \_\_\_\_\_\_ Labor Equipment Sub Manhours Matl EXTERIOR INSULATION FINISH SYSTEM, FIELD 0724020100 0.10 APPLIED, 1" EPS INSULATION 20962.00 S.F. Unit values 1.33 2.34 0.00 0.14 Totals 2850.83 \$27,789 \$48,996 \$2,145 \$0 \$78,930 0724020150 EIFS, FIELD APPLIED, HEAVY DUTY REINFORCEMENT 1050.00 S.F. ADD 0.76 . 0.03 2.03 0.00 0.04 1.24 Unit values. \$33 \$0 \$793 \$2,132 Totals 46.20 \$1,306 \$29,095 \$49,789 \$2,178 \$0 \$81,062 2898 U07 MOIST PROT

Line #	Descripti	.on				
	Manhours	Matl	Labor I	Equipment	Sub	Total
*======================================	========	=======	=======			
ESTIMATE TOTAL	2898	\$29,095	\$49,789	\$2,178	\$0	\$81,062
SALES TAX MATL MARKUP LABOR MARKUP	0.00% 0.00% 0.00%	\$0 \$0	\$0			
EQUIPT MARKUP SUB MARKUP	0.00% 0.00%			\$0	\$0	
TOTAL BEFORE C CONTINGENCY BOND PROFIT	ONTINGENC 10.00% 0.00% 10.00%	\$29,095	\$49,789	\$2,178	\$0	\$81,062 \$8,106 \$0 \$8,106
JOB TOTAL						\$97,274

BLDG 2647

Date:

12-Oct-94

Description:

WINDOW/ WALL INSULATION ECO-2

Project:

LIMITED EEAP(GLASSBid Date:

Location:

JOB TOTAL

FORT KNOX, KY

94013.02 Job #:

Sq. footage:

\*\*\*\*\*

City indx:Louisville, KY

SUMMARY \_\_\_\_\_ Manhours Matl Labor Equipment Sub \$0 \$81,062 \$2,178 \$29,095 \$49,789 U07 MOIST PROT 2898 \$0 \$81,062 \$29,095 \$49,789 \$2,178 2898 TOTAL \$0 SALES TAX 0.00% 0.00% \$0 MATL MARKUP \$0 0.00% LABOR MARKUP \$0 EQUIPT MARKUP 0.00% \$0 0.00% SUB MARKUP \$0 \$81,062 \$49,789 \$2,178 TOTAL BEFORE CONTINGENC \$29,095 \$8,106 10.00% CONTINGENCY · \$0 0.00% BOND \$8,106 10.00% PROFIT

\$97,274

### FT KNOX LIMITED EEAP (GLASS)

#### ECO - 2: WINDOW/ WALL INSULATION

									PA	PAGE 1 OF 3
	BUILDING NUMBER:	2647		BUILDING HE OUTSIDE DE TEMPERATU	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	Ture Jre	SETPOINT:	70 F 1 F 69 F		
	INFILTRATION LOSSES =	-	AIR CHGS X	473022	VOL (CUFT) X	H 69	F TEMP DIFF X 0.019	= 610	0.62	MBTU/HR
	FLOOR LOSSES =	722	LINEAR	LINEAR FEET OF PERIMETER	METER X	69	F TEMP DIFF X 0	0.81 =	0.04	MBTU / HR
	SURFACE HEAT LOSSES WOOD SLOPED ROOF =	26807	AREA (SF) X	0.433	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	₹ =	0.80	MBTU / HR
	WOOD SIDING/STUD WALL =	12418	- AREA (SF) X	0.2017	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	₹ =	0.17	MBTU / HR
	8" CINDER BLOCK WALL =		- AREA (SF) X	0.426	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	₩ #	0.00	MBTU / HR
٠.	CORR MTL PNL WALL =		- AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	ZE =	0.00	MBTU / HR
	PAINTED SGL PANE CLERESTORY WINDOWS =	8544	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	. #	0.73	MBTU / HR
•	CLR SGL PANE WINDOWS =	2528	– AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	# "	0.22	MBTU / HR
	MTL OVERHEAD DOORS =		- AREA (SF) X	0.56	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	R "	0.00	MBTU / HR
	WOOD GLAZED O'HEAD DR =		- AREA (SF) X	0.583	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	E.	0.00	MBTU / HR
	LG MTL SLIDING DOOR =	110	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	E E	0.00	MBTU / HR
	METAL PERSONNEL DR=		AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	# "	0.00	MBTU / HR
	WOOD/GLAZED PERSONNEL=	193	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURI DIFFERENCE	BB . II	0.01	MBTU / HR
			, I .							

MBTU / HR MJ/HR

= 2.59 = 2,732.62

TOTAL BASELINE HEAT LOSSES

### FT KNOX LIMITED EEAP (GLASS)

#### ECO - 2: WINDOW/ WALL INSULATION

								PAGE 2 OF	2 OF 3
BUILDING NUMBER:	2647		BUILDING OUTSIDE TEMPERA	BUILDING HEATING TEMPERATURE SETPOINT: OUTSIDE DESIGN TEMPERATURE TEMPERATURE DIFFERENCE	ATUR URE	70	յ աա		
INFILTRATION LOSSES =	-	AIR CHGS X	473022	VOL (CUFT) X 6	69 F	F TEMP DIFF X 0.019	11	0.62	MBTU / HR
FLOOR LOSSES =	722	LINEAR FEET OF		PERIMETER X	69 F	F TEMP DIFF X 0.81	11	0.04	MBTU / HR
SURFACE HEAT LOSSES WOOD SLOPED ROOF =	26807	AREA (SF) X	0.433	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	II	0.80	MBTU / HR
WOOD SIDING/STUD WALL =	12418	AREA (SF) X	0.0984	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	н	0.08	MBTU / HR
8" CINDER BLOCK WALL =	0	AREA (SF) X	0.426	U VALUE (BTU/ HR-SF-F) X	69	F TEMPERATURE DIFFERENCE	R	0.00	MBTU / HR
CORR MTL PNL WALL =	0	AREA (SF) X	0.17	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
PAINTED SGL PANE CLERESTORY WINDOWS =	8544	AREA (SF) X	0.1697	U VALUE (BTU/ ) HR - SF - F) X	· . 69	F TEMPERATURE DIFFERENCE	II	0.10	MBTU / HR
CLR SGL PANE WINDOWS =	2528	AREA (SF) X	1.235	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	II	0.22	MBTU/HR
MTL OVERHEAD DOORS =	0	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	II	0.00	MBTU / HR
WOOD GLAZED O'HEAD DR =	0	AREA (SF) X	0.583		69	F TEMPERATURE DIFFERENCE	II	0.00	MBTU/HR
LG MTL SLIDING DOOR =	110	AREA (SF) X	0.56	U VALUE (BTU/ HR - SF - F) X	69	F TEMPERATURE DIFFERENCE	н	0.00	MBTU / HR
METAL PERSONNEL DR=	0	AREA (SF) X	0.56		69	F TEMPERATURE DIFFERENCE	11	0.00	MBTU / HR
WOOD/GLAZED PERSONNEL≕	193	AREA (SF) X	0.615	U VALUE (BTU/ HR - SF - F) X	.69	F TEMPERATURE DIFFERENCE	11	0.01	MBTU / HR

MBTU / HR MJ/HR

= 1.87 = 1,976.67

**TOTAL ECO HEAT LOSSES** 

#### FT KNOX LIMITED EEAP (GLASS)

**ECO - 2: WINDOW/ WALL INSULATION** 

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ECO - 2	%09	τ-	70	4616	1.87		\$6.60	\$4.62	\$10.84
BASELINE	%09	_	70	4616	2.59		\$6.60	\$4.62	\$10.84
	SYSTEM EFFICIENCY	OUTSIDE DESIGN TEMP (F)	HTG TEMP SETPOINT (F)	HEATING DEGREE DAYS	TOTAL HEAT LOSSES	(MBIO/HK)	\$ /MBTU -FUEL OIL	\$ /MBTU -NATURAL GAS	\$ /MBTÜ -PPG

	GLOSSARY OF TERMS			.81 = CONSTANT FOR SLAB PERIMETER UNINSULATED FROM ASHRAE	CORR FACTOR = EMPIRICAL CORRECTION FACTOR FOR HEATING EFFECT VS	65 F DEGREE-DAYS FROM ASHRAE FUNDAMENTALS 1989 PG28.2
2647	GLOS			AB PERIME	RICAL COR	OM ASHRAE
BUILDING NUMBER		1 MBTU = 1055 MJ	0.019=CONSTANT	.81 = CONSTANT FOR SL	CORR FACTOR = EMPI	65 F DEGREE-DAYS FRC

	ANNUAL HEATING	TING ENERGY	G ENERGY CONSUMPTION (DEGREE DAY METHOD)	(DEGREE	AY ME	ETHO!	()	
BASELINE =	2.59	MBTU/HR X 461 SYS EFF X 69	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 69 TEMP DIFFERENCE	24 HRS/DAY	6,9	6,931.13	MBTU/YR	
	6,931.13	MBTU/YR X	CORR FACTOR	τ-	ti		6,931.13	MBTU/YR
. ECO - 2 =	1.87	MBTU / HR X 461 SYS EFF X 69	MBTU / HR X 4616 DEGREE DAYS X 24 HRS/DAY SYS EFF X 69 TEMP DIFFERENCE	24 HRS/DAY	= 5,0	5,013.69	MBTU/YR	
	5,013.69	MBTU/YR X	CORR FACTOR	<b>-</b>		•	5,013.69	MBTU/YR
	ECO - 2 ANNU	ANNUAL HEATING	JAL HEATING ENERGY CONSUMPTION SAVINGS	TION SAVINGS	11 11		1,917.43 2,022,890.22	MBTU/YR

	ANNUAI	ANNUAL HEATING ENERGY COST	ENERGY	COST			
BASELINE	E = 6,931.13	MBTU/YR X 4.62	4.62	\$ /MBTU	II	32,021.80 \$ MR	\$ MR
ECO - 2 :	5,013.89	MBTU/YR X 4.62	4.62	\$ /MBTU	u	= 23,163.27 \$ MR	* YR
	ECO - 2 ANN	ECO - 2 ANNUAL HEATING ENERGY COST SAVINGS =	ENERGY C	OST SAVINGS	8	8,858.53 \$ /YR	\$ MR